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# SV-iV5 User Manual

**2.2-37kW [200V] / 2.2-375kW [400V]**

**Safety Instructions**

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS Industrial Systems

*Thank you for purchasing LS Vector Drives!*

# SAFETY INSTRUCTIONS

To prevent injury and property damage, follow these instructions.
Incorrect operation due to ignoring instructions will cause harm or damage.
The seriousness of which is indicated by the following symbols.

| | |
|---|---|
| ⚠ DANGER | This symbol indicates the instant death or serious injury if you don't follow instructions |
| ⚠ WARNING | This symbol indicates the possibility of death or serious injury |
| ⚠ CAUTION | This symbol indicates the possibility of injury or damage to property |

■ The meaning of each symbol in this manual and on your equipment is as follows.

⚠ This is the safety alert symbol.
Read and follow instructions carefully to avoid dangerous situation.

This symbol alerts the user to the presence of "dangerous voltage" inside the product that might cause harm or electric shock.

■ After reading this manual, keep it in the place that the user always can contact easily.

■ This manual should be given to the person who actually uses the products and is responsible for their maintenance.

## ⚠ WARNING

- **Do not remove the cover while power is applied or the unit is in operation.**
  **Otherwise, electric shock could occur.**

- **Do not run the inverter with the front cover removed.**
  Otherwise, you may get an electric shock due to high voltage terminals or charged capacitor exposure.

- **Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.**
  Otherwise, you may access the charged circuits and get an electric shock.

- **Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power and after checking the DC link voltage is discharged with a meter (below DC 30V).**
  Otherwise, you may get an electric shock.

- **Operate the switches with dry hands.**
  Otherwise, you may get an electric shock.

- **Do not use the cable when its insulating tube is damaged.**
  Otherwise, you may get an electric shock.

- **Do not subject the cables to scratches, excessive stress, heavy loads or pinching.**
  Otherwise, you may get an electric shock.

## ⚠CAUTION

- **Install the inverter on a non-flammable surface. Do not place flammable material nearby.**
  Otherwise, fire could occur.

- **Disconnect the input power if the inverter gets damaged.**
  Otherwise, it could result in a secondary accident and fire.

- **After the input power is applied or removed, the inverter will remain hot for a couple of minutes.**
  Otherwise, you may get bodily injuries such as skin-burn or damage.

- **Do not apply power to a damaged inverter or to an inverter with parts missing even if the installation is complete.**
  Otherwise, electric shock could occur.

■ **Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the drive.**
Otherwise, fire or accident could occur.

# OPERATING PRECAUTIONS

1) Transport and Installation

- Be sure to carry inverter in a proper way suitable for its weight, or it may result in damage to inverter.
- Do not pile up inverters above allowable limit.
- Be sure to install the inverter as directed in this instruction manual.
- Do not turn off the power supply to the damaged inverter.
- Do not open the front cover while carrying the inverter.
- Do not place the heavy material on the inverter.
- The direction of installation should be observed properly as criterions specified in this manual show.
- Make sure that you should not put screw, metal material, water, oil and the inflammable something else.
- Keep in mind that inverter is very vulnerable to drop from the mid air and strong shock.
- Be certain to use the inverter under the following conditions.

| | | |
|---|---|---|
| Environment | Ambient temperature | - 10 ~ 40 ℃ (Non-frozen) |
| | Humidity | Below 90% RH (Dewdrop should not be formed) |
| | Storage temperature | - 20 ~ 65 ℃ |
| | Ambient condition | Free of corrosive gas, inflammable gas, oil-waste and dust |
| | Altitude/vibration | Below 1000m above sea level, Below 5.9m/sec² (=0.6g) |

2) Wiring works

- Do not connect phase-leading capacitors, surge filter, radio noise filter to the output of inverter.
- Output terminals (terminals named U, V, W respectively) should be connected in a proper phase sequence.

3) Adjustment before starting trial operation

- Be sure to check relevant parameters for the application before starting trial operation.

4) Directions

- Be sure not to approach the machine when retry function is selected. The machine may start working suddenly.
- Stop key on the keypad should be set to be in use. For safety, additional emergency stop circuit should be required.
- Inverter restarts if alarm condition is cleared while FX/RX signal is on. Therefore, be sure to operate the alarm reset switch after checking if FX/RX signal is off.
- Never modify the inverter for inappropriate use.

- Motor may not be protected by electronic thermal protection.
- Do not start or stop the inverter by the magnetic contactor installed at the input of inverter.
- Noise filter should be used for the minimization of troubles by electromagnetic noise. Electronic equipments close to the inverter should be protected against the damage caused by troubles.
- Be sure to install the AC reactor at the input of inverter in case of input voltage unbalance. Otherwise, generator or phase-leading capacitors may be destroyed by the harmonic current from inverter.
- If 400V class motor is used with the inverter, insulation-enforced motor should be used or countermeasures against the suppression of micro-surge voltage generated by the inverter should be carried out. Otherwise, micro-surge voltage is generated across input terminal for the motor and this voltage lowers allowable insulation break-down voltage and then, may cause the destruction of the motor.
- Be sure to set the parameters once more, in case of initialization of parameters, all values of parameters is set to values of factory setting.
- High speed operation can be set easily, therefore be sure to check the performance of motor or machine before changing parameter value.
- DC braking function cannot produce a zero-servo torque. If required, additional equipment should be installed.
- When Inverter trip or emergency stop (BX) occurs without keypad connected, LED on the control board will blink by the interval of 0.5 sec. But LED will blink by 1 sec when keypad is connected.

5) Countermeasure against malfunction troubles

- If inverter is damaged and then gets into uncontrollable situation, the machine may lead to the dangerous situation, therefore to avoid this situation, be sure to install the additional equipments such as brake.

6) Maintenance, inspection and parts replacement

- Do not perform the megger (insulation resistance check) test on the control board.
- Please refer to Chapter 8 (intervals for parts replacement).

7) Disposal

- Handle the inverter as an industrial waste when disposing of it.

8) General instructions

Many of the diagrams and drawings in this instruction manual show the inverter without a circuit breaker, a cover or partially open. Never run the inverter like this. Always place the cover with circuit breakers and follow this instruction manual when operating the inverter.

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# Chapter 1 - Introduction



This instruction manual is designed for **LS STARVERT-iV5 series Vector Control Inverters**, which have excellent characteristics in speed and torque control with pulse encoder mounted on the shaft of 3 phase induction motor, and covers installation, maintenance, wiring and operation for these inverters.

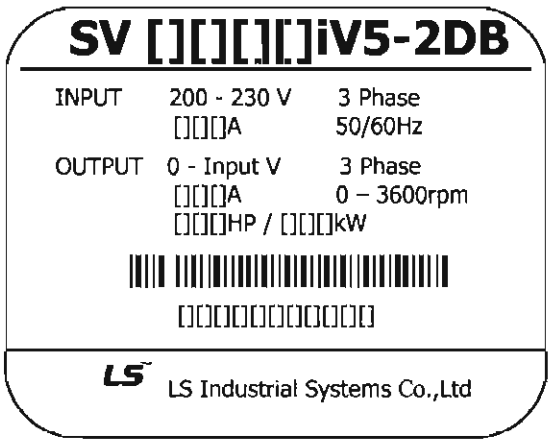
## 1.1 Key Features

- Current Controlled Vector Control Inverter with Speed Sensor using IGBT as Power Semiconductor Device.
- Tension/Torque Control and Wide Variety of Process Control
- Process PI Control, Draw Control, Droop Control, Synchronous Control, WEB Control etc.
- Auto-tuning of Motor Parameters for Precise Speed/Torque Control: Rotational/Standstill mode
- Encoder error (H/W and S/W) detection function
- Inverter Application

| Application | Applicable Machine/System | Features |
|---|---|---|
| Process Control | ● Steel Strip<br>● Paper Mill<br>● Textile<br>● Film<br>● Coater<br>● Printing Machine | Tension Control<br>Wide Range of Speed Control |
| Hoisting Control | ● Lifts (Elevators)<br>● Parking<br>● Stacker Crane<br>● Crane<br>● Hoist | High Speed Operation<br>High Starting Torque<br>Positioning<br>Wide Range of Speed Control |
| Machine Control | ● Machine Tool<br>● Wire Drawing<br>● Extruder | High Speed Operation<br>High Starting Torque<br>Positioning |
| Others | ● Conveyor<br>● Industrial Washing Machine | High Speed Operation<br>Positioning |

## 1.2 Inverter Nameplate and Model

### 1.2.1 Inverter nameplate (Example)




### 1.2.2 Inverter Model Name

**SV [][][][] iV5 – 2 DB (MD) (380V) (EMC)**

- **LS STARVERT Series**
- **Max. Applicable Motor**
  **022 : 2.2kW ~ 3750 : 375kW**
- **iV5 Series**
- **Input Voltage**
  **2 : 200V Class (200 ~ 230V) ,**
  **4 : 400V Class (380 ~ 480V)**
- **Built-in DB Circuit**
  **DB : Built-in DB Circuit (DB Resistors Integrated)**
  **Blank : No Built-in DB Circuit (Use external DB Unit)**
- **MD : Mold Type (2.2~22kW)**
  **(All of the specifications other than the dimension based on the specifications of the metallic cover type 5.5~22kW class.)**
- **Input Voltage**
  **(380V) : 380V Input Voltage – 30~220kW(400V)**
  **Blank : Below 22kW (200V/400V) 280~375kW(400V)**
- **ENCODER TYPE**

**① 2.2~220kW**
- **Blank : 5V Line Drive, 15V Open Collector**
- **24V ENC : 24V Line Drive/Open Collector**

**② 280~375kW**
- **5/12/15V ENCODER : 5V Line Drive, 15V Open Collector**
- **24V ENCODER : 24V Line Drive/Open Collector**

# Chapter 2 - Specification

## 2.1 Standard Specification

### 2.1.1 200V Class

| SV[][][]iV5-2(DB) | | 022 | 037 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. applicable motor output Note1) | [HP] | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| | [kW] | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Output | Capacity [kVA](Note2) | 4.5 | 6.1 | 9.1 | 12.2 | 17.5 | 22.5 | 28.2 | 33.1 | 46 | 55 |
| | Rated current [A] | 12 | 16 | 24 | 32 | 46 | 59 | 74 | 88 | 122 | 146 |
| | Speed | 0 ~ 3600(rpm) | | | | | | | | | |
| | Voltage | 200 ~ 230V(Note3) | | | | | | | | | |
| Input | Voltage | 3ϕ 200 ~ 230V(-10% ~ +10%) | | | | | | | | | |
| | Frequency | 50 ~ 60Hz(±5%) | | | | | | | | | |
| Inverter weight [kg(lbs)] | | 6(13) | 6(13) | 14(30) | 14(30) | 28(61) | 28(61) | 28(61) | 28(61) | 42(93) | 42(93) |

### 2.1.2 400V Class

| SV[][][]iV5-4(DB) | | 022 | 037 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. applicable motor output Note1) | [HP] | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| | [kW] | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Output | Capacity [kVA](Note2) | 4.5 | 6.1 | 9.1 | 12.2 | 18.3 | 22.9 | 29.7 | 34.3 | 46 | 57 |
| | Rated current [A] | 6 | 8 | 12 | 16 | 24 | 30 | 39 | 45 | 61 | 75 |
| | Speed | 0 ~ 3600(rpm) | | | | | | | | | |
| | Voltage | 380 ~ 480V(Note3) | | | | | | | | | |
| Inverter weight [kg(lbs)] | | 6(13) | 6(13) | 14(30) | 14(30) | 28(61) | 28(61) | 28(61) | 28(61) | 42(93) | 42(93) |

| SV[][][][]iV5-4(DB) | | 450 | 550 | 750 | 900 | 1100 | 1320 | 1600 | 2200 | 2800 | 3150 | 3750 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. applicable motor output Note1) | [HP] | 60 | 75 | 100 | 120 | 150 | 175 | 215 | 300 | 373 | 420 | 500 |
| | [kW] | 45 | 55 | 75 | 90 | 110 | 132 | 160 | 220 | 280 | 315 | 375 |
| Output | Capacity [kVA](Note2) | 70 | 85 | 116 | 140 | 170 | 200 | 250 | 329 | 416 | 468 | 557 |
| | Rated Current [A] | 91 | 110 | 152 | 183 | 223 | 264 | 325 | 432 | 546 | 614 | 731 |
| | Speed | 0 ~ 3600(rpm) | | | | | | | | | | |
| | Voltage | 380 ~ 480V(Note3) | | | | | | | | | | |
| Inverter weight [kg(lbs)] | | 63 (139) | 63 (139) | 68 (150) | 98 (216) | 98 (216) | 122 (269) | 122 (269) | 175 (386) | 243 (536) | 380 (838) | 380 (838) |
| Input | Voltage | 3ϕ 380 ~ 480V(-10% ~ +10%)(Note4) | | | | | | | | | | |
| | Frequency | 50 ~ 60 Hz (±5%) | | | | | | | | | | |

**Note)**

1. It represents the output capacity of maximum applicable motor in case LG-OTIS 4- pole motor is used.
2. Rated capacity (= √ 3*V*I) is calculated based on 220V for 200V class, 440V for 400V class.
3. Maximum output voltage cannot be generated above specified input voltage.
4. Derate the rated current by 10% when the input voltage is in the range of 507 ~ 528V.

※ The electrical specifications of the MD type (2.2~22kW Class) are the same as the above.

| SV[][][]iV5-2/4DB(MD) | 055 | 075 | 110 | 150 | 185 | 220 |
|---|---|---|---|---|---|---|
| Inverter weight [kg(lbs)] | 7.7(16.9) | 7.7(16.9) | 13.7(30.2) | 13.7(30.2) | 20.3(44.7) | 20.3(44.7) |

## 2.2 Common Specification

| Items | | | Detailed Specification |
|---|---|---|---|
| Inverter type | | | Voltage source inverter using IGBT |
| Control | Control method | | ● Field oriented vector control inverter with speed sensor attached |
| | Speed control accuracy | | ● Analog setting: ± 0.2%(25 ± 10℃) of max. Speed<br>● Digital setting : ± 0.01%(0 ~ 40℃) of max. Speed |
| | Speed setting resolution | | ● Analog setting: ± 0.005% of maximum Speed<br>● Digital setting: 0.1 rpm |
| | Cut-off frequency of ASR | | 50Hz |
| | Torque control accuracy | | 3% |
| | Overload Capacity | | CT: 150%/1Min |
| | Accel/ Decel | Time setting | 0.00 ~ 6000.0 sec (Time unit can be set) |
| | | Combination | 4 Combinations of acceleration/Deceleration Time |
| | | Pattern | Linear, S-Curve |
| Braking | Braking method | | Dynamic braking using external resistors |
| | Braking torque | | 150% |
| | Braking resistor | | External braking resistor should be provided. |
| Input | Speed settings | | ● Digital setting via keypad<br>● Multi-step speed setting by input terminal selection<br>● Analog input settings of –10~10V or 4~20mA<br>● Remote setting by option card |
| | Analog input | | ● 3 channels (AI1, AI2, AI3*, (AI4,AI5: Extended I/O))<br>● -10→10V, 10→10V, 0→10V, 10→0V,0→20mA, 20→0mA, (*AI3(AI5:Extended I/O): Motor NTC/PTC selectable)<br>● Selectable among 15 different user-defined functions<br>● AI3, AI5(Motor NTC):only available with LG-OTIS motors. |
| | Contact input | | ● FX, RX, BX, RST, P1 ~ P7<br>● Selectable among 41 different user-defined input functions |
| Output | Analog output | | ● 2 channels (AO1, AO2)<br>● -10V → 10V, 10 → -10V, 0 → 10V, 10 → 0V output<br>● Selectable among 40 different user-defined functions |
| | Contact output | | ● 2 channels (1A-1B, 2A-2B)<br>● Fault alarm relay: 1 channel (30A-30C, 30B-30C) |
| | Open Collector | | 1 Channel (OC1/EG) |
| Protection | | | Overcurrent, Overvoltage, Low voltage, Inverter overheat, Inverter thermal sensor malfunction, Motor overheat, Motor thermal sensor malfunction, Overspeed, Instantaneous IGBT gate block (BX), Fuse blown open, External Trip, Pulse encoder malfunction, Electronic thermal function, Inverter overload, Ground fault current, IGBT short, Communication error |
| Environment | Installation condition | | Indoor, Free of Corrosive gas and Direct sunlight |
| | Ambient temperature | | -10 ~ 40°C (Non-frozen condition) |
| | Humidity | | Below RH 90% (Dewdrop should not be formed) |
| | Cooling method | | Forced ventilation by cooling fan |
| | Altitude, Vibration | | Below 1000m above sea level, Below 5.9m/s$^2$ (=0.6G) |

# Chapter 3 – Installation and Wiring

**This chapter describes general items for the installation and wiring of an inverter and includes instruction for wiring to power terminal and control one and caution in case of wiring, and also explains the function of each terminal for both power and control.**

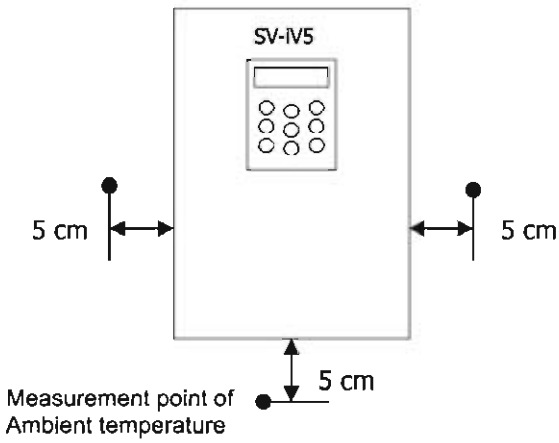
## 3.1 Caution on Installation

### 3.1.1 Do not install the inverter in a location where excessive vibration is present.

Be cautious when installing on presses or moving equipment.

### 3.1.2 Caution on ambient temperature

Ambient temperature greatly affects inverter lifetime, therefore be sure to keep the ambient temperature of installation location at –10 to 40℃.



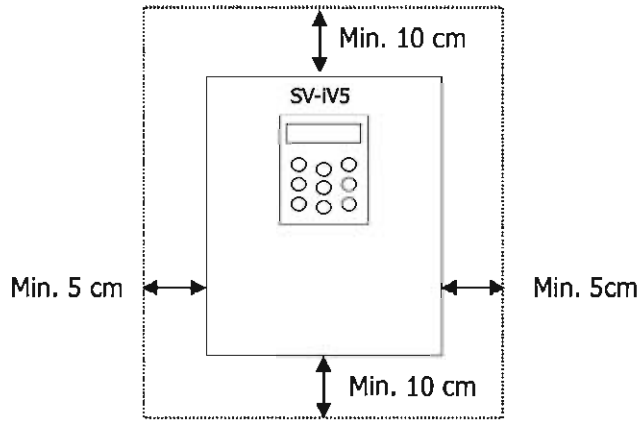

### 3.1.3 Install the inverter on the uninflammable material. The inverter operates at high-temperature.

### 3.1.4 Avoid a humid and hot location.

### 3.1.5 Install the inverter in a location free of oil mist and dust.

Totally enclosed panel can be used to protect the inverter against that materials.

### 3.1.6 Secure the installation space enough to protect the inverter against the overheating.




### 3.1.7 Special care should be taken in case the inverter is to be installed in the panel.

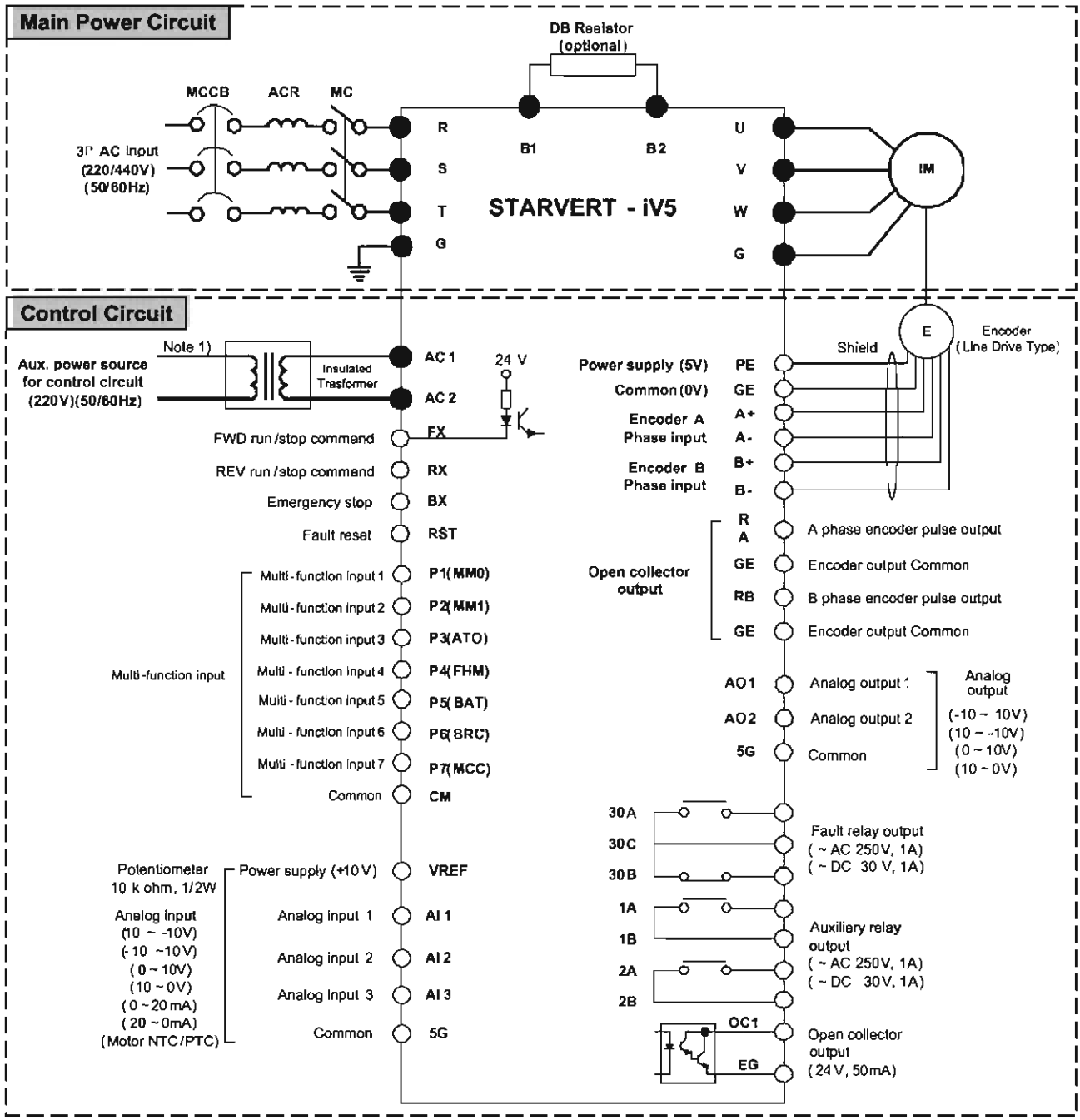
In case more than 2 inverters are to be installed or ventilation fan is to be installed in the panel, make sure that inverter and ventilation fan is properly installed. If they are poorly installed, it causes the increase of an ambient temperature and less effective ventilation. Therefore, be sure to keep the ambient temperature of inverter below the allowable temperature.

### 3.1.8 Install the inverter tightly not to get loose using proper sized bolt or screw.

## 3.2 Basic Wiring

■ **SV022, 037, 055, 075, 110, 150, 185, 220iV5-2(DB)**

**SV022, 037, 055, 075, 110, 150, 185, 220iV5-4(DB)**




Note) ■ : Main circuit ,○ : Control circuit

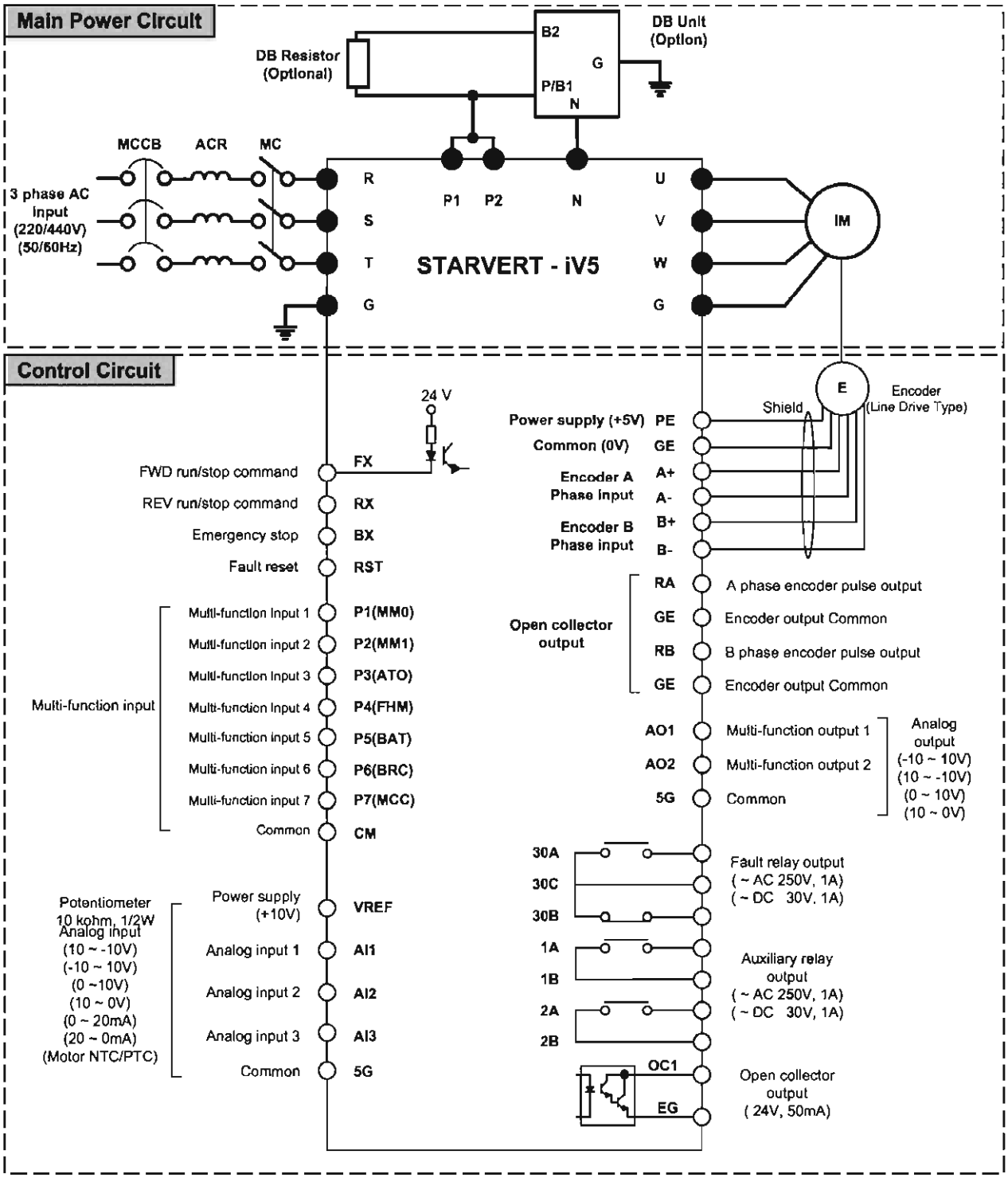
※ 5G: Encoder power source common terminal for SV022/037iV5

Note 1) It is used when inverter control circuit is energized from auxiliary power source (220 VAC) separated from main power supply. Use insulated transformer to separate from main power supply. (Transformer capacity: Above 100VA recommended) Only 5.5~22kW-2/4(Press) supported (Other products will be released later.)

■ **SV300, 370iV5-2**

**SV300, 370, 450, 550, 750, 900, 1100, 1320, 1600, 2200, 2800, 3150, 3750iV5-4**

Note: AC Fans for 300~2200iV5-4 series should be changed the input power source of transformer 1st tap corresponding with that of inverter. (Factory default is 380VAC)




Note) ●: Main circuit, ○: Control circuit

※ SIO terminal indication for SV2800~3750iV5: PE → PENT, GE → G24X

## 3.3 Power Circuit Terminal

### 3.3.1 Power circuit terminal arrangement

| ⚠ CAUTION |
| --- |
| Be sure that "N" is not Neutral Line but DCN(-) and P is DCP(+) |

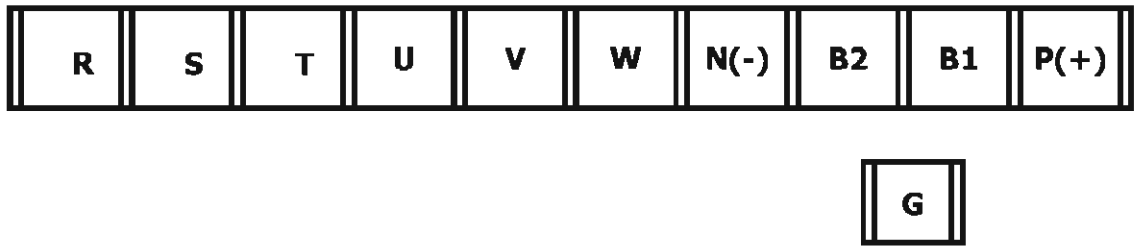


■ **SV022, 037, 055, 075, 110, 150, 185, 220iV5-2(DB)**

SV022, 037, 055, 075, 110, 150, 185, 220iV5-4(DB)

■ **SV110, 150, 185, 220iV5-2(DB)(MD)**

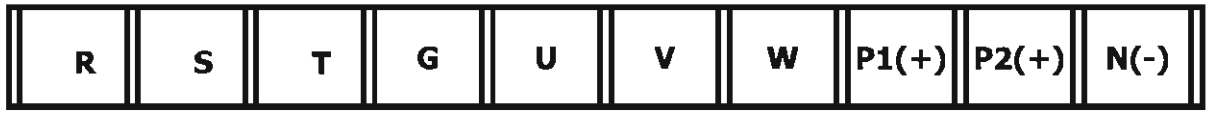
**SV110, 150, 185, 220iV5-4(DB)(MD)** *(MD) : Mold Type



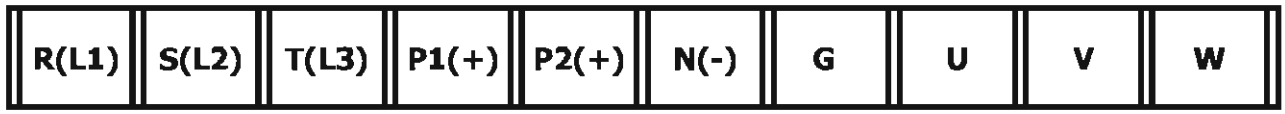

■ **SV300, 370iV5-2**

**SV300, 370, 450, 550, 750iV5-4**

■ **SV900, 1100, 1320, 1600, 2200iV5-4**




■ **SV2800, 3150, 3750iV5-4**

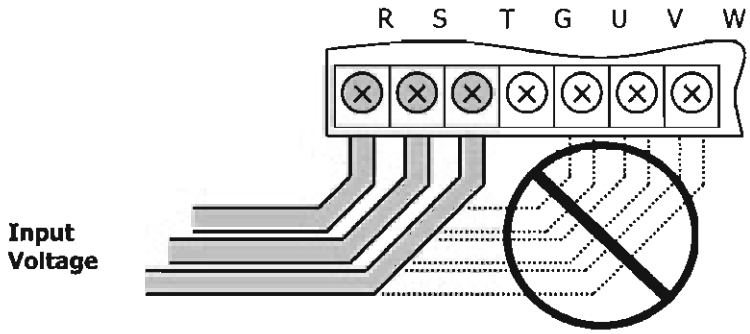


### 3.3.2 Power circuit terminal description

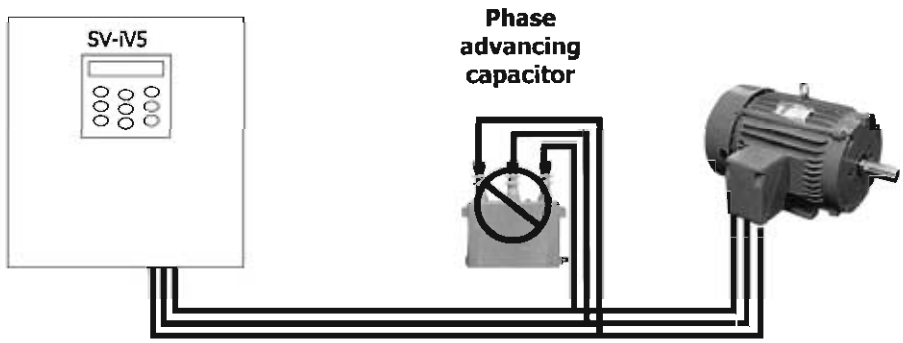
| Name | Function | Description |
|---|---|---|
| R, S, T | 3 Phase input power supply | Connected to 3 phase input power supply<br>1) 200V Class : 200 ~ 230V, 50/60Hz<br>2) 400V Class : 380 ~ 480V, 50/60Hz |
| U, V, W | Inverter Output | Connected to 3 phase induction motor |
| G | Grounding | Used for inverter frame earth |
| B1, B2 | Braking Resistor | Connected to braking resistor |
| P1, P2 | DC Reator and DB Unit | Used for DC Reactor, DB Unit and DC link common connection |
| N | DB Unit | Used for DB Unit and DC link common connection |

### 3.3.3 Cautions to be required for wiring to power circuit terminal

① Connect terminals ( R, S and T) to 3 phase input power supply after checking inverter nameplate attached on the inverter. Never connect terminals (U, V and W) to 3 phase input power supply. It results in lethal damage to the inverter.




② Never connect the phase advancing capacitor to the inverter output. If already installed, remove the phase advancing capacitor clearly.



③ Cable between inverter output and motor should be less than 30m long. If cable gets long, surge voltage appears across motor terminals depending on the cable parameters. Especially, in 400V class motor case, insulation withstanding voltage may be decreased. Use an insulation-enforced motor when 400V class motor is used.
④ Crimp terminal with insulation cap should be used for the input power supply and the motor.
⑤ After finishing wiring, be certain to remove all the wire or cable scraps inside the inverter.
⑥ Use the shield cable or twist-paired wire for control circuit terminal. Do not put them into the same wiring duct for the power terminal.
⑦ When wiring is changed after operating the inverter, be sure to check LCD window on the keypad or charge lamp is turned off. Capacitors inside inverter are charged with high voltage and it may result in lethal injury.
⑧ Below 22kW inverter, B1 and B2 on the power terminal should not be connected to anything else other than DB resistors.



### 3.3.4 Main power circuit wire sizes and grounding wire size

① Main Power Circuit Wire Sizes
If wiring for the main power terminal is not performed properly, it may cause severe damage to inverter or lethal injury to inverter operator. **Be sure to use 600V, 75℃ copper wire.**

| Inverter Capacity | | Wire Size | | | |
|---|---|---|---|---|---|
| | | $mm^2$ | | AWG or kcmil | |
| | | R, S, T | U, V, W | R, S, T | U, V, W |
| 200V | 2.2 kW | 2.5 | 2.5 | 14 | 14 |
| | 3.7 kW | 4 | 4 | 12 | 12 |
| | 5.5 kW | 6 | 6 | 10 | 10 |
| | 7.5 kW | 10 | 10 | 8 | 8 |
| | 11 kW | 16 | 16 | 6 | 6 |
| | 15 kW | 25 | 25 | 4 | 4 |
| | 18.5 kW | 35 | 35 | 2 | 2 |
| | 22 kW | 35 | 35 | 2 | 2 |
| | 30 kW/37 kW | 70 | 70 | 1/0 | 1/0 |
| 400V | 2.2/3.7 kW | 2.5 | 2.5 | 14 | 14 |
| | 5.5 kW | 4 | 4 | 12 | 14 |
| | 7.5 kW | 4 | 4 | 12 | 12 |
| | 11 kW | 6 | 6 | 10 | 10 |
| | 15 kW/18.5 kW | 16 | 16 | 6 | 8 |
| | 22 kW | 25 | 25 | 4 | 6 |
| | 30 kW/37 kW | 35 | 35 | 4 | 4 |
| | 45 kW/55 kW | 50 | 50 | 2 | 2 |
| | 75 kW/90 kW | 120 | 120 | 1/0 | 1/0 |
| | 110 kW | 150 | 150 | 4/0 | 4/0 |
| | 132 kW/160 kW | 240 | 240 | 400 | 400 |
| | 220 kW | 300 | 300 | 500 | 500 |
| | 280 kW | 400 | 400 | 700 | 700 |
| | 315 kW | 2 x 240 | 2 x 240 | 2 x 400 | 2 x 400 |
| | 375 kW | 2 x 300 | 2 x 300 | 2 x 500 | 2 x 500 |

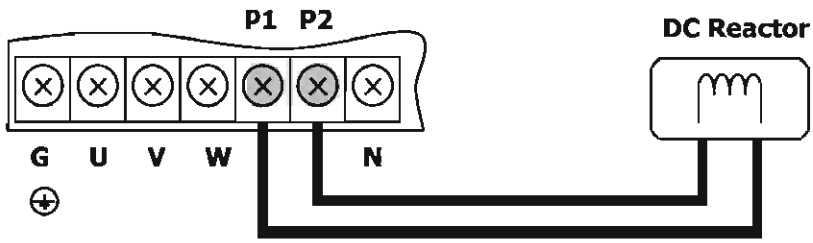
1) Apply the rated torque to terminal screws. Loose screws can cause of short circuit or malfunction. Tighting the screws too much can damage the terminals and cause a short circuit or malfunction.

② Grounding Wire Size and Caution to be taken

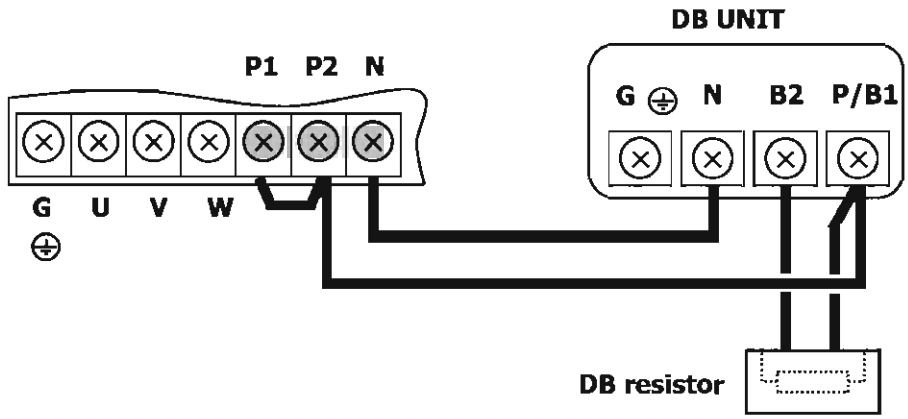
- Be sure to ground the motor and the inverter to prevent electric shock injury. (200V class: ground impedance 100Ω, 400V class: ground impedance 10Ω)
- Connect the inverter ground to the ground terminal exclusively used for the inverter.
- It is strongly recommended that as thick a grounding wire as possible be used and wire be short.

| Motor Capacity | Ground wire size( $mm^2$ ) | |
|---|---|---|
| | 200V Class | 400V Class |
| 2.2 ~ 3.7 kW | 4 | 2.5 |
| 5.5 ~ 7.5 kW | 6 | 4 |
| 11 ~ 15 kW | 16 | 10 |
| 18.5 ~ 22 kW | 25 | 16 |
| 30 ~ 37 kW | 25 | 16 |
| 45 ~ 75 kW | - | 25 |
| 90 ~ 132 kW | - | 35 |
| 160 ~ 220 kW | - | 95 |
| 280 ~ 315 kW | - | 185 |
| 375 kW | - | 240 |

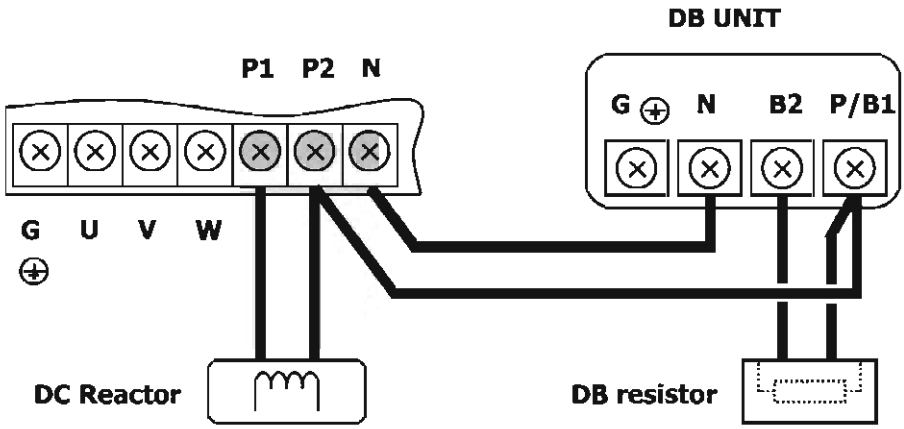
### 3.3.5 Wiring DC Reactor (Option) (30kW and higher)




### 3.3.6 Wiring DB Unit (Option) (30kW and higher)



### 3.3.7 Wiring guide when using both of DC reactor (Option) and DB Unit(option) (30kW and higher)



## 3.4 Control Board and Terminal

### 3.4.1 Control board Jumper description

- **Control board Jumper description according to S/W version**

Set jumper of control board as following, if it is not set rightly, it may result in misworking

(S/W version can be verified in display group of Function code list)

1) Before S/W V2.00 (V1.XX ~ V1.93)

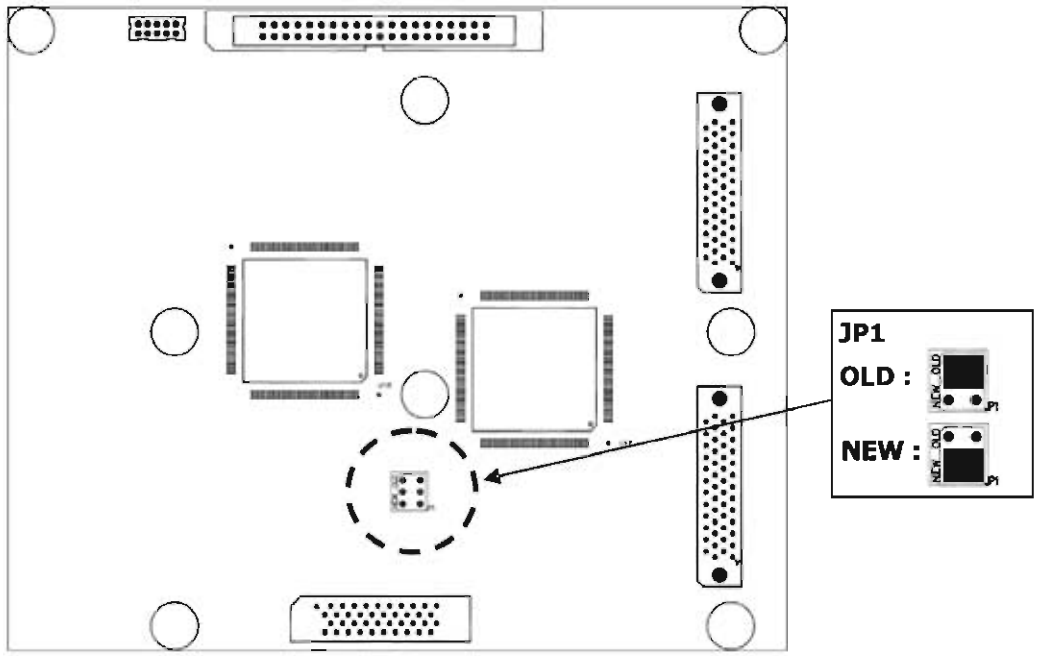
Set JP1 to **OLD** in Control board

2) After S/W V2.00 (V2.00 ~ )

Set JP1 to **NEW** in Control board.(Factory default)

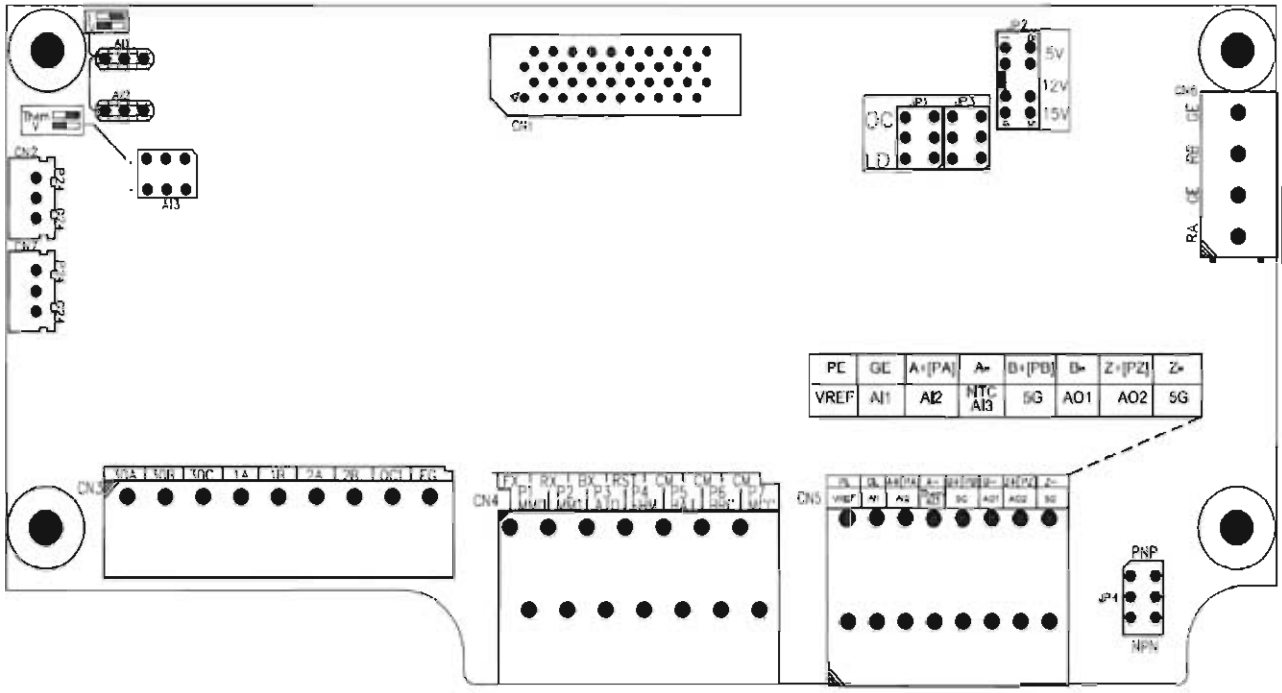
Note) The products which released after 2007 are being set up to "NEW"

- **iV5 Control Board (5.5 ~ 375kW Class)**

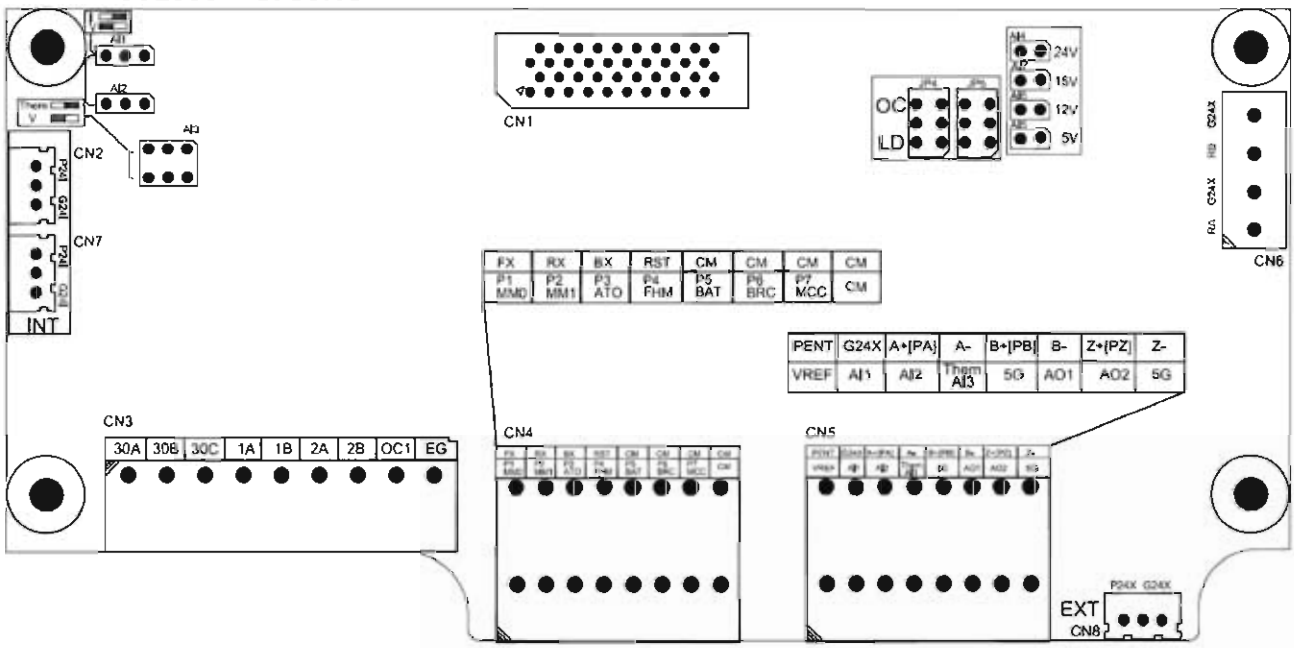


### 3.4.2 Control circuit terminal arrangement

■ **SV022 ~ 2200iV5**




■ **SV2800 ~ 3750iV5**



### 3.4.3 Control circuit terminal function description

| Item | Name | Function | Description |
|---|---|---|---|
| Contact Input | FX | Forward Run Command | ● Forward/Reverse RUN Command is ON when closed to CM in NPN input mode.<br>● Motor stops when FX/RX is ON or OFF at the same time. |
| | RX | Reverse Run Command | |
| | BX | Emergency Stop | ● ON when closed to CM in NPN input mode, Free-run to Stop and deceleration to stop. It does not trigger fault alarm signal. |
| | RST | Fault Reset | Resets when fault condition is cancelled. |
| | P1(MM0) | Multi-function input contact | ● 1 function can be selected among 27 different functions shown below.<br>(Multi-step speed 1 / 2 / 3, Jog, MOP Up / Down / Save / Clear, Analog Hold, Main Drive, 2nd function, Accel./Decel. Time selection, 3 Wire RUN, External trip (B contact), Power failure prevention, Reverse rotation prevention, Process PI Disable, Timer input, Soft start cancel, ASR PI Gain switch-over, ASR P/PI switch-over, Flux command value switch-over, Pre-excitation, Speed/Torque control, Torque limit ON/Off, Torque bias ON/Off) |
| | P2(MM1) | | |
| | P3(AT0) | | |
| | P4(FHM) | | |
| | P5(BAT) | | |
| | P6(BRC) | | |
| | P7(MCC) | | |
| | CM | COMMON | ● In NPN input mode, it turns On when each contact is closed to CM terminal.<br>● In PNP input mode, it turns On when each contact is closed to external 24V input. |
| Analog Input | VREF | Power supply for analog setting | ● Reference voltage by variable resistor ( + 10V ) : 10kΩ |
| | AI1 | Voltage/ Current Signal Input | ● Voltage input (-10→10V, 10→-10V, 0→10V, 10→0V) current input (0→20mA, 20→0mA), Motor NTC/PTC selectable via Multi-function Analog input.<br>● Jumper setting in Voltage Input: **Jumper set as default)**<br>➔ AI1, AI2: Jumper set on left side,<br>AI3: Switch set on left("V") side<br>● Jumper setting in Current Input<br>➔ AI1, AI2: Jumper set on right side<br>● Motor NTC (When using **LG-OTIS Motor Only**)<br>➔ AI3: switch set on right("Them") side.<br>● Selectable 15 functions as following:<br>(Speed, Process PI controller, Process PI controller feedback, Draw, Torque, Magnetic flux, Torque bias, Torque limit, Motor NTC/PTC...) |
| | AI2 | | |
| | AI3/Them | Voltage input Motor NTC/PTC Input | |
| | 5G | COMMON | ● COMMON terminal for Analog input |
| Encoder Input | PE | P/S (Power supply) for Pulse Encoder[1)] | +5V Line Drive Power |
| | GE | | 0V |
| | A+ | Encoder A-phase signal | ● A, B signal for Line Drive Type Encoder.<br>● Set the JP2 switch at "P5" on I/O PCB and set the JP4 switch to "LD" for the use of Line Drive.<br>**※ Jumper set as default** |
| | A- | | |
| | B+ | Encoder B-phase signal | |
| | B- | | |
| | PE | P/S for Open Collector [Note1)] | +15V Open Collector Power |
| | GE | | 0V |
| | PA | Encoder A-phase signal | ● A, B signal for Complementary or Open Collector Type Encoder.<br>● Set the JP2 switch at "P15" on I/O PCB and set the JP4 switch to "OC" for the use of Open Collector. |
| | PB | Encoder B-phase signal | |
| | Z+(PZ) | Encoder Z-phase signal | **Caution) The usages of Z-phase signal are as follows and its functions will be available soon.**<br>● Use for Z-phase pulse provided encoders. |

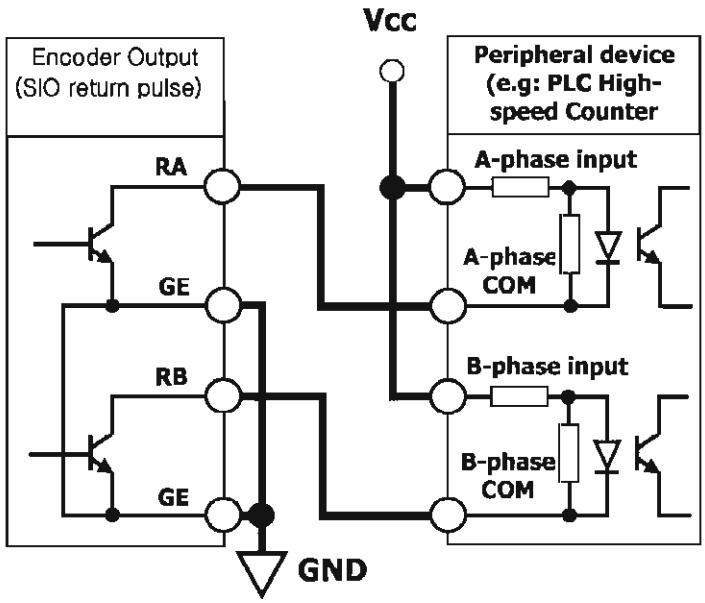
| Item | Name | Function | Description |
|---|---|---|---|
| | Z- | | ● Z+ and Z- signals are used for Line Drive type, so set the JP5 switch to "LD".<br>● PZ signal is used for Open Collector type, so set the JP5 switch to "OC". |
| Encoder Output | RA | Encoder signal output : A-phase | Encoder A, B phase signal output – Open Collector Type Note4 |
| | GE | Output Common | |
| | RB | Encoder signal output : B-phase | |
| | GE | Output Common | |
| Analog Output | AO1 | Analog Output 1 | ● -10V → 10V, 10 → -10V, 0 → 10V, 10 → 0V output<br>● Selectable among 34 (Motor speed, speed ref. 1~2, Torque command 1~2, torque current, flux ref., flux current, Inverter output current/voltage, Motor Temp, DC link voltage... ) |
| | AO2 | Analog Output 2 | |
| | 5G | COMMON | ● COMMON terminal for Analog Output |
| Relay output | 1A | Multi-function relay output 1 (A Contact) | ● Selectable among the following 18 functions;<br>Zero speed detect, Speed detect (Bi-directional), Speed detect (Uni-directional), Speed reach, Speed deviation, Torque detect, On Torque limit, Motor overheat, Inverter overheat, on low voltage, Inverter running, Inverter regenerating, Inverter ready, Timer output, Brake Output |
| | 1B | | |
| | 2A | Multi-function relay output 2 (A Contact) | |
| | 2B | | |
| | OC1 | Open Collector Ouput | |
| | EG | | |
| | 30A | Fault alarm A contact | ● Outputs when fault occurs.<br>● Deactivated in BX condition. |
| | 30B | Fault alarm B contact | |
| | 30C | COMMON | ● COMMON for 30A, 30B |
| Switch | JP1 | Encoder Input-pulse Type | LD (Line Drive) / OC (Open Collector or Complementary) |
| | JP2[Note3)] | Encoder Power Supply | DC +5V / +12V / +15V selectable usages |
| | JP4[Note4)] | PNP/NPN Input mode | PNP/NPN contact input mode selection |

Note 1) Wire Encoder power source according to series I/O board as below:
SV022~2200iV5 Class: PE: "+" , GE: "−"
SV2800~3750iV5 Class: PENT: "+", G24X: "−"

Note 2) I/O board of SV2800~3750iV5 Class is classified into 2 types: 24V and 5/12/15V Encoder power
Encoder power is set by PIN(AI4(24V), AI5(5V), AI6(12V), AI7(15V))

Note 3) NPN/PNP Input mode selection are not supported for SV2800~3750 iV5 series' I/O board.

Note 4) Example wiring of Encoder output




**Warning**

Wiring must be considered with input circuit . Because encoder output is open collector type. The figure is shown the wiring when inverter is connected with High-speed counter of LSIS PLC.

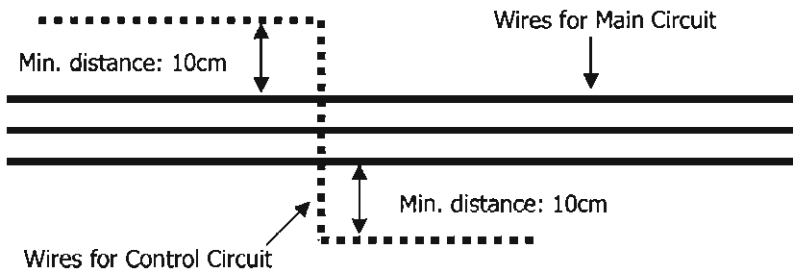
- **Additional Functions of Extended I/O(EXTN _ I/O) Control board terminal**

| Item | Name | Function | Description |
|---|---|---|---|
| Analog Input | AI1 | Voltage Input<br>Current Input | • Extended I/O(EXTN_I/O) board is added analog Input AI4, AI5.<br>• How to use terminal Pin:<br>- Voltage Input : AI1, AI2,AI3, AI4, AI5<br>- Current Input : AI1, AI2, AI3, AI4<br>- Motro NTC/PTC input : AI5<br><br>Note) Jumper setting and functions are explained at I/O control terminal description. |
| | AI2 | | |
| | AI3 | | |
| | AI4 | | |
| | AI5/Them | Voltage Input<br>Motor NTC/PTC Input | |
| | 5G | COMMON | COMMON terminal for Analog Input |

### 3.4.4 Wiring the control circuit terminal

① Shield wire or vinyl insulated wire are highly recommended to be used for the control circuit terminal.
② Be sure to use twisted shield wire if wiring distance gets too long.
③ Wire should be at least as thick as 0.2 ~ 0.8 $mm^2$ (18 ~ 26 AWG).
④ Screwing torque limit should be kept under 5.2 lb-in.
⑤ Maximum interrupting capacity of auxiliary contact 1, 2 is of AC 250V/1A, DC 30V/1A.
⑥ Maximum interrupting capacity of fault alarm relay A, B contact is of AC 250V/1A, DC 30V/1A.
⑦ Open collector output 1, 2 and 3 can be used below maximum of 24V/100mA.
⑧ Wires for the control circuit terminal should be separated from ones for the power circuit terminal, if possible and in case wires for both control circuit terminal and the power circuit one cross each other, they should be crossed at right angles (90°).






### 3.4.5 Caution on wiring pulse encoder

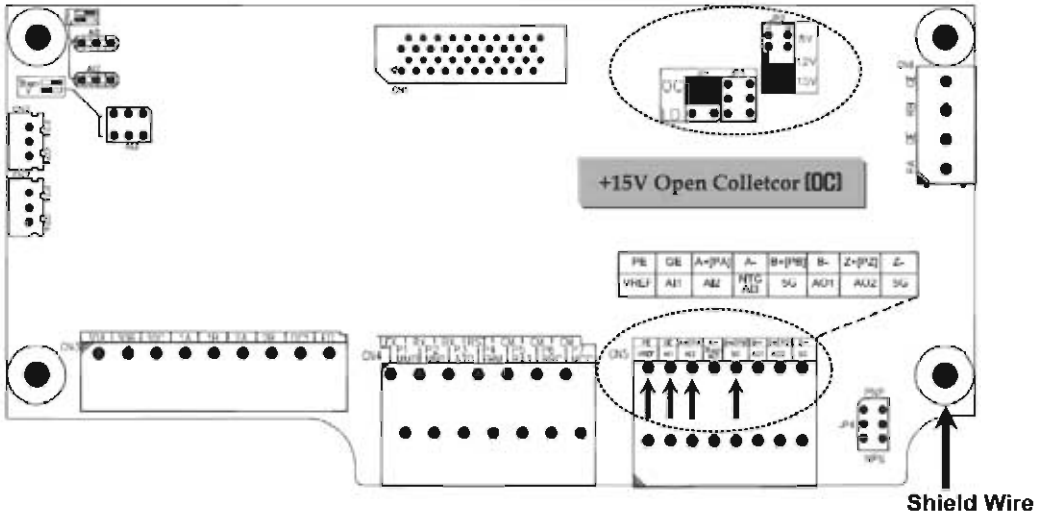
1) Check-up of the coupling and alignment of motor and encoder shaft

① Be sure to mount the pulse encoder at the location where it rotates at the same speed as the motor does.
② In case there is speed slip between the motor shaft and encoder shaft, the motor may not start or it causes mechanical vibration.
③ Poor alignment of motor and encoder shaft results in torque ripple and causes mechanical vibration which has the same frequency as the motor speed at the constant speed region.

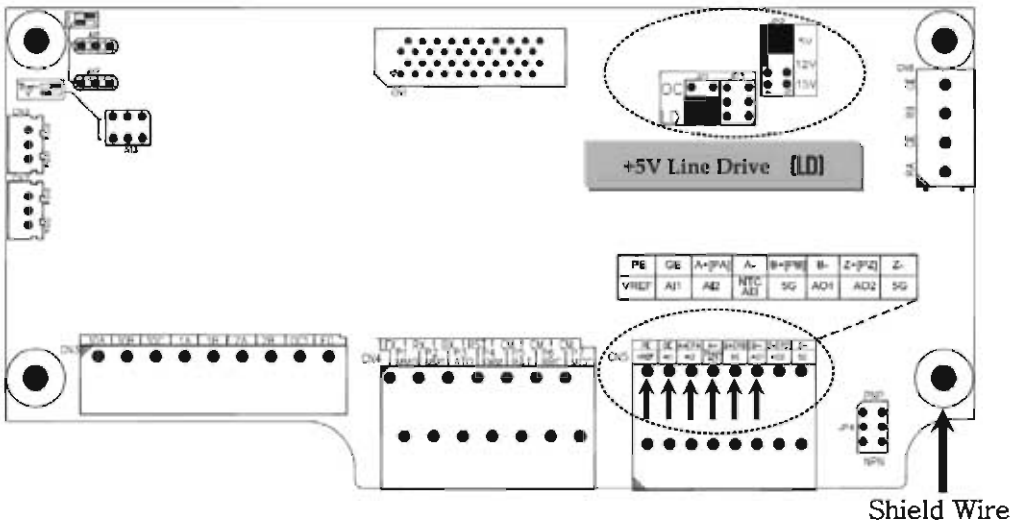
2) Wiring the pulse encoder

① Be sure to **use twist paired shield wire** and **ground shield wire to screw for earth on the I/O PCB.**
② Signal wires should be separated from the power lines, if possible. Electromagnetic noise may affect the pulse encoder output signals.

### 3.4.6 Encodder wiring and switch setting method(+15V Complementary / Open Collector Type)




### 3.4.7 Encoder wiring and switch setting method (+5V Line Drive) ※ Jumper set as default

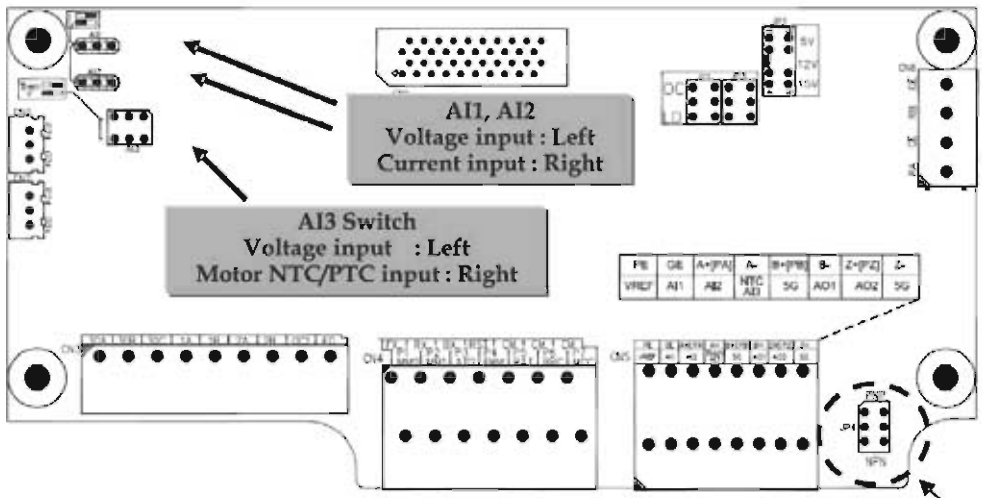



## ⚠ CAUTION

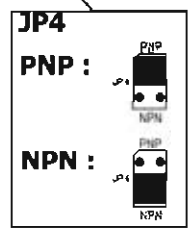
- NEVER change the switch setting for Encoder Type during inverter run. Otherwise, it may cause inverter trip, adversely affecting the entire system.
  Therefore, verify the switch is correctly set before operation.

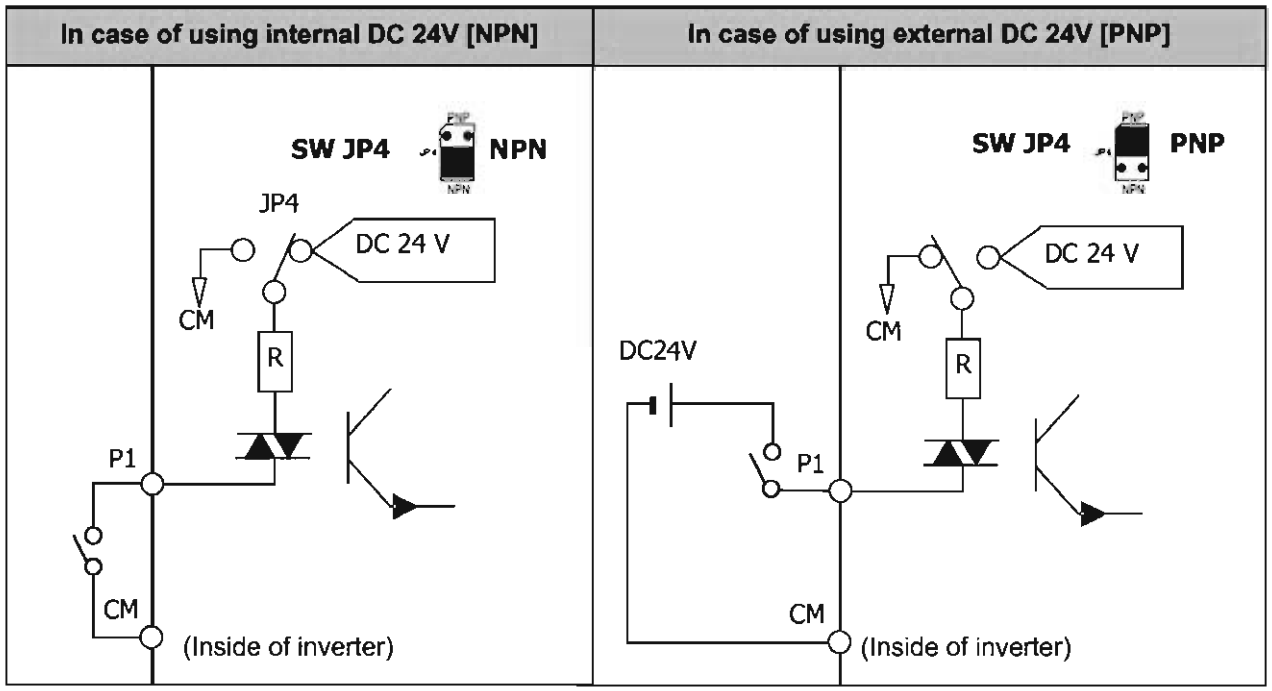
### 3.4.8 Analog input jumper setting (Voltage/Current/Motor NTC/PTC Input) and PNP/NPN input mode switch setting

※ Jumper set as default : Voltage Input (Left)




※ Factory Default Jumper Setting: NPN (down side)




- **Guaranteed PNP type input voltage (external DC 24V): On voltage (DC 19~25.2 V)/ Off voltage (DC 7V or less)**

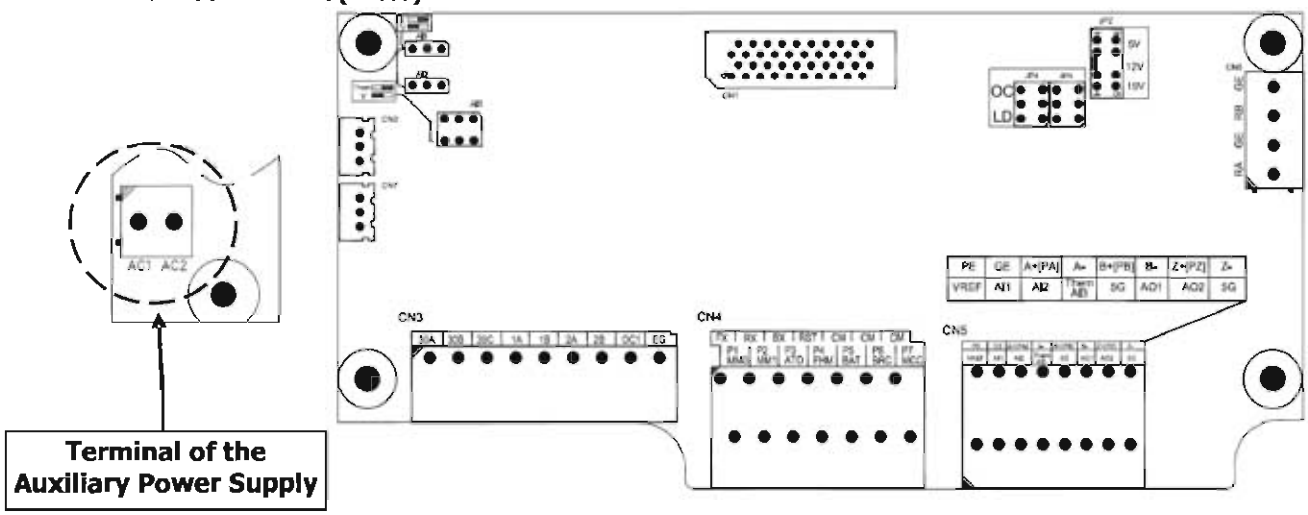
## ⚠ CAUTION

- NEVER change the jumper setting during inverter run. Otherwise, it may cause inverter trip, adversely affecting the entire system.
- Motor NTC input for Analog Input 3 is ONLY available when OTIS Motor is connected.
  If user use a motor other than LG-OTIS with different NTC(PTC) specification and use this function, it will lead to motor overheat and damage to the motor.
- Do not change the setting of PNP input switch during inverter operation. It can influence to the system since contact input is changed. Set the switch correctly before inverter operation.

### 3.5 Terminal of the Auxiliary Power Supply

#### 3.5.1 The position of the terminal

■ **SV055 ~ 220iV5(Press)**




#### 3.5.2 Function description of auxiliary terminal block

| Symbol | Terminal Name | Terminal Description | Input Power |
|---|---|---|---|
| AC1, AC2 | Auxiliary power input | Inputs single-phase AC input source | 220V (-10 ~ +10%), 50/60Hz |

#### 3.5.3 Wiring and Precaution of auxiliary terminal block

① Connect the auxiliary power supply through insulated transformer separated with main power supply.

② User polyvinyl chloride insulated wire for auxiliary power cable.

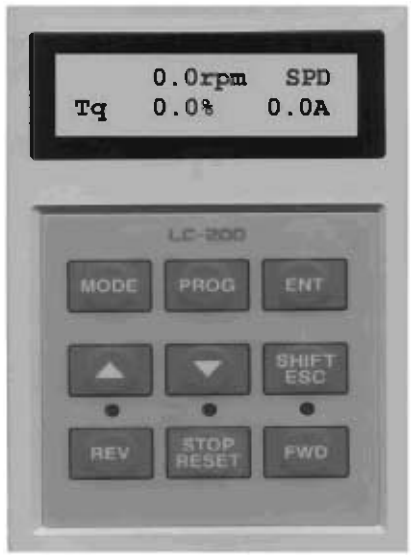
③ User the cable above 0.5mm$^2$ (20 AWG).

# Chapter 4 - Trial Operation

## 4.1 Keypad Operation

LCD Keypad can display up to 32 alphanumeric characters and monitor or set parameter values to operate the inverter and the motor properly. As follows are keypad view and explanation on each key/LED on the keypad.

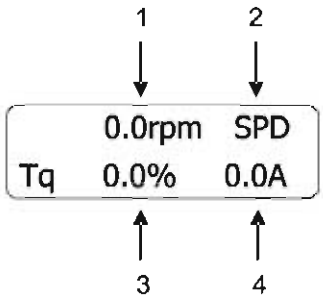
**<Keypad View>**




| Items | Name | Function | Description |
|---|---|---|---|
| Key | MODE | Mode | Enables to move to the other groups (Initial Screen →DIO → PAR → FUN...) and go to the first code in the same group. |
| | PROG | Program | Enables to modify setting values. |
| | ENT | Enter | Enables to move to the other groups (Initial Screen ← DIO ← PAR ← FUN...) and save the changed setting values. |
| | ▲(Up) | Up | Moves to the next code or increments setting values. |
| | ▼(Down) | Down | Moves to the next code or decrements setting values. |
| | SHIFT/ESC | Shift/ESC | Acts as Shift key in a setting mode and as ESC key in other mode. |
| | REV | Reverse RUN | Reverse RUN command is enabled. |
| | STOP/RESET | Stop/Reset | Stop key during inverter operation.<br>Resets fault when inverter returns to normal after fault has occurred. |
| | FWD | Forward RUN | Forward RUN command is enabled. |
| LED | (REV) | Reverse RUN | Lit when motor is in reverse revolution.<br>Blinks on acceleration/deceleration, lit in a constant speed |
| | (STOP/RESET) | Stop/Reset | Lit when the motor stops.<br>Blinks when fault has occurred. |
| | (FWD) | Forward RUN | Lit when motor is in forward revolution.<br>Blinks on acceleration/deceleration, lit in a constant speed |

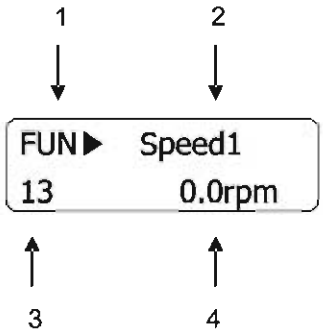
## 4.2 Keypad LCD Display

### 4.2.1 LCD Start-up display




| No. | Function | Description |
|---|---|---|
| 1 | Motor speed | Real motor speed in RPM (Revolution Per Minute) |
| 2 | Motor control Mode | SPD: Speed control mode<br>TRQ: Torque control mode<br>WEB: WEB control mode<br>BX: Emergency stop<br>BAT : Battery-operated mode |
| 3 | Generating torque | Displays % ratio to the rated torque of a motor. |
| 4 | Output current | Inverter output current in RMS |

### 4.2.2 Group display




| No. | Function | Description |
|---|---|---|
| 1 | Parameter group | Displays the name of each parameter group. There are DIS, DIO, PAR, FUN, CON, AIO, USR and 2nd group. |
| 2 | Code name | Displays a code name to be set. |
| 3 | Code Number | Displays a code name to be set. |
| 4 | Code data and unit | Displays a code data and a code unit to be set. |

## 4.3 Setting of Parameter Values

In case inverter is to be in use using a keypad, proper parameter values can be set depending on the load and operation condition. For more detailed information, refer to Chapter 6.

First, move on to the code in a group where is intended to change parameter value. cursor (■) blinks by pressing [**PROG**] key. Parameter value can be set using (SHIFT/ESC)], [▲(Up)] and [▼(Down)] keys and then can be saved by entering [ENT] key.

Note) In some cases, data will not be changed for the following two reasons.

* Some data cannot be changed during inverter operation.
* Parameter data lock function is set. (PAR_04 [Parameter Lock] is enabled)



Example) In case the 1st acceleration time is to be changed from 10(sec) to 15(sec), it can be set as shown below.

| | |
|---|---|
| 0.0rpm SPD<br>Tq 0.0% 0.0A | Initial Display |
| FUN▶ Jump code<br>00 1 | Move to FUN Group by using [MODE] Key |
| FUN▶ Jump code<br>00 40 | Press [PROG] Key → Enter 40 by [(SHIFT/ESC)], [▲(Up)], [▼(Down)] Key →[ENT] |
| FUN▶ Acc Time-1<br>40 10.00 sec | Acc time 1 is settable. |
| FUN▶ Acc Time-1<br>40 ■10.00 sec | Press [PROG] Key.<br>Setting Mode(Cursor(■) appears and blinks) |
| FUN▶ Acc Time-1<br>40 10.00 sec | Move the Cursor(■) to the position to be changed using [(SHIFT/ESC)] key. |
| FUN▶ Acc Time-1<br>40 15.00 sec | Set the data using [▲(Up)], [▼(Down)] |
| FUN▶ Acc Time-1<br>40 15.00 sec | Save the changed data by pressing [ENT] key. (Cursor disappears.) |

## 4.4 Data Groups

SV-iV5 series inverters use LCD keypad for user's convenience. Data groups are divided into 12 groups for easy access depending on the inverter application.

| Name | LCD keypad (on the upper left) | Description |
|---|---|---|
| Display group | DIS | Motor speed, Motor control mode, Generating torque, Output current, User selection display, Process PID output/reference/feed-back value, Fault display, User group display setting and so on. |
| Digital I/O group | DIO | Digital input parameters, Digital output parameters and so on. |
| Parameter group | PAR | Parameter initialization, Parameter read / write / lock /password, Motor related constants, Auto-tuning and so on. |
| Function group | FUN | Operating frequency, Operation mode, Stop mode, Acceleration /deceleration time and pattern, Carrier frequency, Electronic thermal selection and so on. |
| Control group | CON | Control mode, ASR PI gain, Process PID gain, Draw control setting, Droop control related constants, Torque control related constants, V/F control related constants and so on. |
| Exterior group | EXT[1)] | It is displayed when Communication option board is installed. Communication setting parameter and so on. |
| Analog I/O group | AIO | Analog Input or Output Parameter and so on. |
| User group | USR | User macro function, macro function save, macro function recall |
| 2nd function group | 2nd | 2nd motor control mode, 2nd motor accel./decel.time, 2nd motor parameters and so on. |
| Elevator group | E/L[1)] | It is displayed when EL_I/O option board is installed, Elevator operation function setting parameter and so on. |
| Synchronous group | SYNC[1)] | It is displayed when SYNC_I/O option board is installed. Synchronous operation function setting parameter and so on. |
| WEB group | WEB | Diameter and Tension control setting parameter while WEB control. |

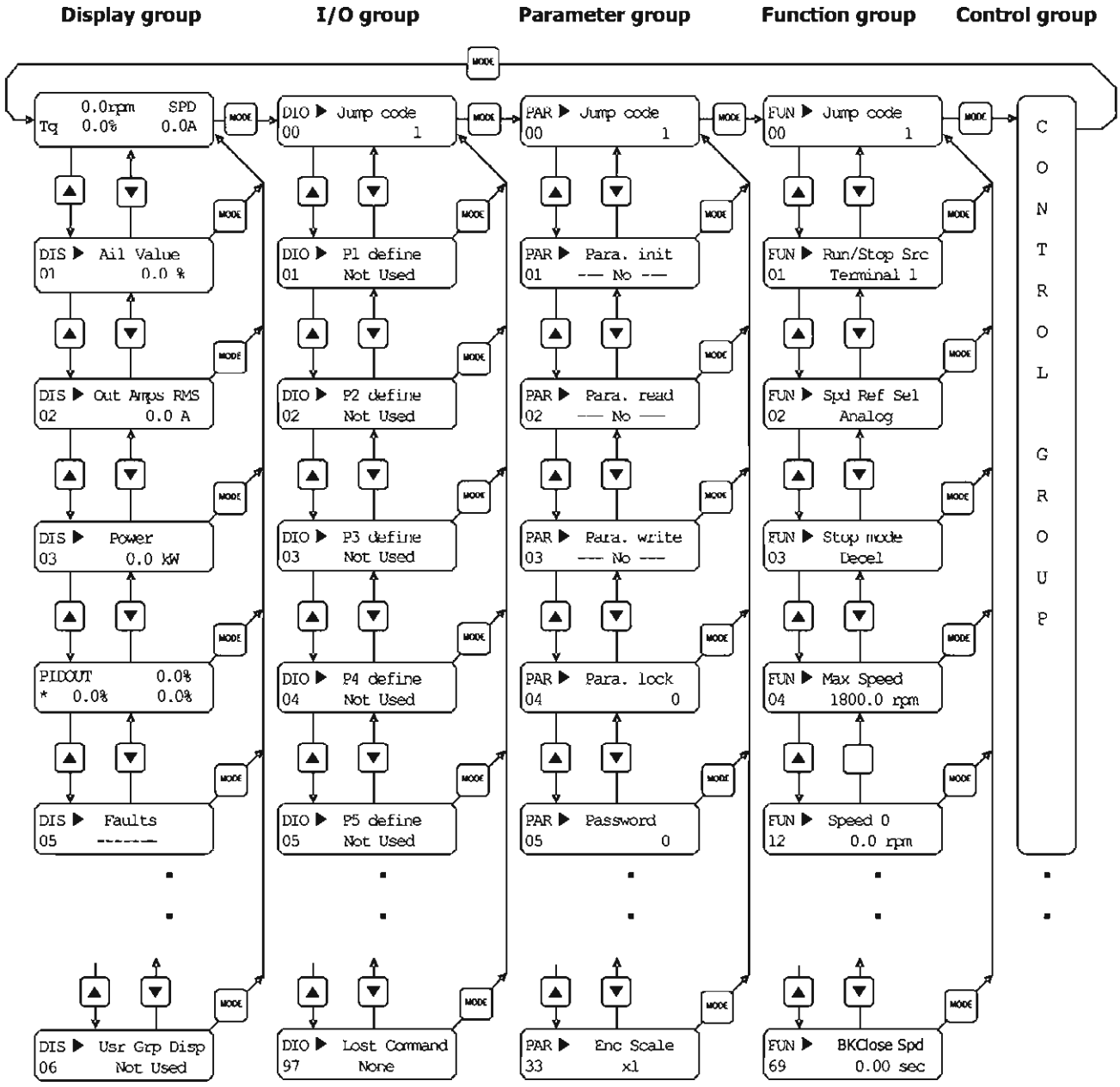
1) It is displayed when option board is installed, Refer to the option manual for more details

Refer to Chapter 6. Function Description for more details.

Refer to the description of Chap. 7 for more information about WEB group.

- **Group transfer in the keypad**

For transfer to another group, [MODE] key is used and ▲(Up), ▼(Down) key is used to move up and down in the same group.




- User group and 2nd group is omitted.
- In these group transfers, User Group, 2nd Group, AIO Group and WEB Group are omitted.

## 4.5 Auto-Tuning

Parameters such as stator resistance ($R_s$), stator leakage inductance (sL ), flux current (IF), rotor time constant ( $\tau_r$) and stator self-inductance (Ls) are indispensable for obtaining an excellent control performance in the vector control and are automatically measured and set using auto-tuning function.

■ SV-iV5 features two types of Auto-tuning: 1) Rotational Auto Tuning
2) Standstill Auto Tuning

### 4.5.1 Motor & encoder parameter setting for auto-tuning

The Motor capacity, Basic speed, Rating voltage, Pole number, Efficiency, Rating slip and Rating current on the nameplate of the motor and the pulse number of encoder should be set before operation.

| LCD Display | Description |
|---|---|
| PAR▶ Motor select<br>07 kW | ● Enter the motor capacity.<br>● Basic capacity is same with Inverter capacity<br>● Enter directly in the PAR_08 after selecting "User Define" if there is no Motor capacity. |
| PAR▶ UserMotorSel<br>08 kW | ● Enter the motor capacity directly at PAR_08 incase that select "User Define" at PAR_07 |
| PAR▶ Enc Pulse<br>10 [][][] | ● Set the pulse numbers per revolution of pulse encoder coupled to the motor shaft. |
| PAR▶ Base Speed<br>17 rpm | ● Set the motor base speed.<br>Note) It is not rating current of name plate.<br><br>Base Speed = 120 X Base Frequency/ Pole number |
| PAR▶ Rated Volt<br>18 V | ● Set the rated voltage of the motor.<br>(Voltage value on the name plate) |
| PAR▶ Pole number<br>19 [] | ● Set the number of poles of the motor. |
| PAR▶ Efficiency<br>20 % | ● Set the efficiency of the motor. If you cannot find the efficiency in name plate, Do not set the Efficiency. |
| PAR▶ Rated-Slip<br>21 rpm | ● Set the rated slip speed of the motor.<br>(Rated slip=synchronous speed–rated speed) |
| PAR▶ Rated-Curr<br>22 A | ● Set the rated current of the motor. |

### 4.5.2 Rotational auto-tuning

1) Precautions

**CAUTION**

Be sure to remove the load connected to the motor shaft before performing rotational auto-tuning. Otherwise, it may lead to damage to the motor or bodily injury. DB resistor should be installed because the inverter repeats abrupt Accel/Decel many times to find the motor constant (Tr) during tuning.

2) Rotational Auto-tuning procedure



| LCD Display | Description | Tuning Time |
|---|---|---|
| PAR ▶ AutoTuneType<br>23 Rotational | Set it to " **Rotational** ". | - |
| PAR ▶ Auto tuning<br>24 ALL1 | Auto-tuning starts when it is set to " **ALL1** ". | - |
| PAR ▶ Auto tuning<br>24 Enc Testing | Checks whether the encoder wiring is properly done and an encoder works well by rotating the motor at 1500 rpm in forward direction. | 30 ~ 35(Sec) |
| PAR ▶ Auto tuning<br>24 Rs Tuning | Stator resistance (Rs) is measured without rotating the motor. | 10 ~ 20(Sec) |
| PAR ▶ Auto tuning<br>24 sL Tuning | The leakage inductance (sL) of the motor is measured without rotating the motor. | 5 ~ 20(Sec) |
| PAR ▶ Auto tuning<br>24 IF Tuning | The flux current (IF) is measured by rotating the motor at 1500 rpm. | 30 ~ 60(Sec) |
| PAR ▶ Auto tuning<br>24 Ls Tuning | Stator self-inductance (Ls) is measured by rotating the motor at 1500 rpm. | 50 ~ 60(Sec) |
| PAR ▶ Auto tuning<br>24 Tr Tuning | Accel/Decel is performed repeatedly to find motor constant (Tr) so that DB Resistor should be connected before starting tuning. Otherwise, "Over Voltage " trip will occur. | 20 ~ 60(Sec) |

| | | |
|---|---|---|
| PAR ▶ Auto tuning<br>24 None<br><br>PAR ▶ Auto tuning<br>24 [][] Error | When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, **verify motor parameters and encoder setting is done properly** and redo the auto-tuning. If the problem persists, contact LS representative. | **Total**<br>**3 ~ 5 (Min.) is required** |

- FWD/REV LED on keypad will blink during Auto-tuning.
- If setting PAR_24 (Auto tuning) to " ALL2 ", all procedure is same as "ALL1" except Encoder Testing will be skipped.
- Motor constants of each can be selected and separately tuned.

(Encoder Test, Rs Tuning, Lsigma, Flux Curr, Ls Tuning, Tr Tuning)

- If encoder phase (A, B) or inverter output wiring is switched during Auto-tuning, " Enc AB Chgd " message will be displayed. In this case, changing PAR_11 (Enc Dir Set) setting from " A Phase Lead " to " B Phase Lead " (or oppositely) will erase the need for changing the wiring.

### 4.5.3 Standstill auto tuning

1) Precaution

Be sure to lock the motor shaft using magnetic brake.

2) StandStill Type Auto-tuning procedure

| LCD Display | Description | Tuning Time |
|---|---|---|
| PAR ▶ AutoTuneType<br>23 Standstill | Set the auto-tuning type to "**Standstill**". | - |
| PAR ▶ Auto tuning<br>24 ALL1 | Auto-tuning starts if **ALL1** is set. | - |
| PAR ▶ Auto tuning<br>24 Rs Tuning | Stator resistance ($R_s$) is measured without rotating the motor. | 20-30 Sec |
| PAR ▶ Auto tuning<br>24 sL Tuning | The leakage inductance (sL) of the motor is measured without rotating the motor. | 90-150 Sec |
| PAR ▶ Auto tuning<br>24 If/Tr/Ls Tuning | Flux current (IF), rotor time constant ($T_r$) and stator self-inductance (Ls) is measured simultaneously without rotating the motor. | 40-70 Sec |
| PAR ▶ Auto tuning<br>24 None<br><br>PAR ▶ Auto tuning<br>24 [][] Error | When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative. | Total: 3-5 minutes |

- FWD/REV LED on keypad will blink during Auto-tuning.
- Motor constants of each can be selected and separately tuned.

(Rs Tuning, Lsigma, Flux Curr, Ls Tuning, Tr Tuning)

## 4.6 Pulse Encoder Check

### 4.6.1 The definition of forward rotation

Forward rotation is of counter-clockwise from the side view of motor shaft.

**Motor**

### 4.6.2 Forward rotation check

Be sure to check if positive(+) speed is displayed when inverter power is on and rotates the motor in the forward direction.

```
  +[][].[]rpm  SPD
Tq      %      A
```

### 4.6.3 Reverse rotation check

Be sure to check if negative(-) speed is displayed when inverter power is on and rotates the motor in the reverse direction.

```
  -[][].[]rpm  SPD
Tq      %      A
```

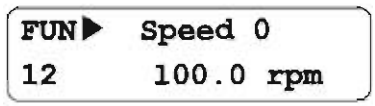
- If speed is displayed 0.0 rpm or unchanged or speed polarity is reversed, check if wiring for the pulse encoder is properly done.
- In case the motor shaft cannot be rotated with hands, refer to next chapter.

## 4.7 Operation by Keypad

### 4.7.1 Parameter setting for keypad operation to rotate the motor at 100 rpm

① RUN/STOP command setting by keypad

② Operating speed reference setting by keypad



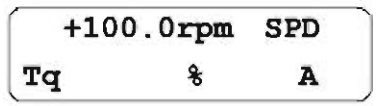

③ Operating speed setting



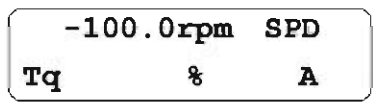
### 4.7.2 Forward / Reverse Run (FWD / REV)

① Low speed operation

- Check if motor speed is +100 rpm in the start-up LCD screen after pressing [FWD] key.




- Check if motor speed is –100 rpm in the start-up LCD screen after pressing [REV] key.




- The following table describes the cases of abnormal rotation due to the incorrect wiring of encoder and/or motor.

| Command | Rotating direction | Speed display | Torque display | Wiring Status |
|---|---|---|---|---|
| FX | Forward | +100.0(rpm) | Below +10% | Normal |
| RX | Reverse | -100.0(rpm) | Below -10% | |
| FX | Forward | -10 ~ -40(rpm) | 150%(Torque Limit) | Encoder wiring reversed |
| RX | Reverse | 10 ~ 40(rpm) | -150%(Torque Limit) | |
| FX | Reverse | -10 ~ -40(rpm) | 150%(Torque Limit) | Phase V and W wiring reversed |
| RX | Forward | 10 ~ 40(rpm) | -150%(Torque Limit) | |
| FX | Reverse | +100.0(rpm) | Below +10% | Encoder and Motor all reversed |
| RX | Forward | -100.0(rpm) | Below -10% | |

- If A and B phase are reversed, be sure to replace A with B phase wire after checking the pulse encoder wiring. Or user does not need to change wiring if PAR_11(Enc Dir Set) setting value is changed from "A Phase Lead" to "B Phase Lead".
- If Motor wires are reversed, be sure to replace V with W phase wire after checking the motor output wiring.
- Torque display is on the basis of the no load operation.

② High Speed Operation

Change the value of FUN_12 to 1000.0(rpm) and Check the display LCD by pressing [FWD], [REV] keys shown below.

- When pressing [FWD] key;

```
  +1000.0rpm  SPD
Tq      %      A
```

- When pressing [REV] key;

```
  -1000.0rpm  SPD
Tq      %      A
```

## 4.8 Operation by Control Terminal

### 4.8.1 Parameter setting

```
FUN▶ Run/Stop Src
01     Terminal 1
```

① Setting RUN/STOP command by terminal

```
FUN▶ Spd Ref Sel
02      Analog
```

② Setting Speed reference by Analog

```
FUN▶ Max Speed
04     1800.0 rpm
```

③ Setting Max. motor speed

```
AIO▶ Ai1 Define
01   Speed Ref
```

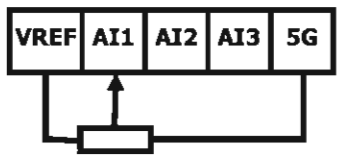
④ Ai1(Analog input terminal) define

```
AIO▶ Ai1 Source
02
```

⑤ Ai1(Analog input terminal) Source define : Select
(-10->10V, 10->-10V, 0->10V,10->0V, 0->20mA, 20->0mA)

### 4.8.2 Wiring example when issuing speed reference using speed potentiometer on AI1 terminal

Connect the potentiometer to VREF, AI1 and 5G as shown below.




..... Control Terminal

Speed Pot. (1/2W, 10kΩ)

### 4.8.3 Adjusting Ai1 Gain and Bias (example of analog input Ai1 setting)

① Out Y2(Gain) Adjustment of Analog input

- Apply 10V or 20mA between AI1 ~ 5G (for setting by potentiometer, adjust it to Max).
- Adjust the other multi analog input terminals in same manner.

| Key Handling | Loader Display | Description |
|---|---|---|
| | AIO▶ Ai1 Out Y2<br>06 100.00 % | Initial LCD display |
| **PROG** | AIO▶Ai1 98.00 %<br>06 Gain 100.00 % | Pressing [PROG] key, shows in upper side the percent of input to output and in low side the gain value be set presently. |
| **▲** | AIO▶Ai1 100.00 %<br>06 Gain 102.00 % | If you try to adjust the gain to show 100.00%, Press [▲(Up)] key repeatedly and set to be 102.00%. |
| **ENT** | AIO▶ Ai1 Out Y2<br>06 102.00 % | After adjusting Gain, if you enter [ENT] key, the adjusted gain value is saved. |

② Out Y1(Bias) Adjustment of Analog input

- Apply 0V or 0mA between AI1 ~ 5G (for setting by potentiometer, adjust it to Min).
- Adjust the other multi analog input terminals in same manner.

| Key Handling | Loader Display | Description |
|---|---|---|
| | AIO▶ Ai1 Out Y1<br>04 0.00 % | Initial LCD display |
| **PROG** | AIO▶Ai1 0.18 %<br>04 Bias 0.00 % | Pressing [PROG] key, shows in upper side the percent of input to output and in low side the Bias value be set presently. |
| **▲** | AIO▶Ai1 0.00 %<br>04 Bias 0.18 % | If you try to adjust the Bias to show 0.00%, Press [▲(Up)] key repeatedly and set to be 0.00%. |
| **ENT** | AIO▶ Ai1 Out Y1<br>04 0.18 % | After adjusting Bias, if you enter [ENT] key, the adjusted Bias value is saved. |

### 4.8.4 FX / RX operation

**1) FX Operation (Forward Run Command by Control Terminal)**

① Apply 0V between AI1 and 5G (for setting by potentiometer, adjust it to Min).

② Check the motor speed display in display group shows "+0.0rpm" after connecting the terminals FX and CM.

③ Increase AI1 voltage little by little and check the speed is increasing (for setting by potentiometer, turn the pot to max. smoothly).

④ To stop the motor, disconnect the FX and CM terminal.

**2) RX Operation (Reverse Run Command by Control Terminal)**

① Apply 0V between AI1 and 5G (for setting by potentiometer, adjust it to Min).

② Check the motor speed display in display group shows "-0.0rpm" after connecting the terminals RX and CM. Increase AI1 voltage little by little and check the speed is increasing (for setting by potentiometer, turn the pot to max. smoothly).

③ To stop the motor, disconnect the RX and CM terminal.

**3)** The cases of abnormal rotation due to the wrong wiring of encoder and/or motor during low speed (about 100rpm) operation by control terminal.

| Command | Rotating direction | Speed display | Torque display | Wiring Status |
|---|---|---|---|---|
| FX | Forward | +100.0(rpm) | Below +10% | Normal |
| RX | Reverse | -100.0(rpm) | Below -10% | |
| FX | Forward | -10 ~ -40(rpm) | 150%(Torque Limit) | Encoder wiring reversed |
| RX | Reverse | 10 ~ 40(rpm) | -150%(Torque Limit) | |
| FX | Reverse | -10 ~ -40(rpm) | 150%(Torque Limit) | Phase V and W wiring reversed |
| RX | Forward | 10 ~ 40(rpm) | -150%(Torque Limit) | |
| FX | Reverse | +100.0(rpm) | Below +10% | Encoder and Motor all reversed |
| RX | Forward | -100.0(rpm) | Below -10% | |

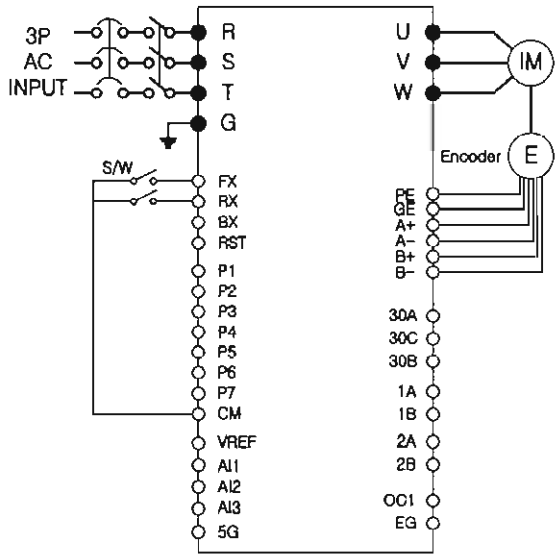
- If A and B phase are reversed, be sure to replace A with B phase wire after checking the pulse encoder wiring.
- If motor wires are reversed, be sure to replace V with W phase wire after checking the motor output wiring.
- It does not need to change wiring if user changes the setting value of PAR_11(Enc Dir Set) from "A Phase Lead" to "B Phase Lead".
- Torque display is on the basis of the no load operation.

| Operation Example (1) | Speed Setting via Keypad + Run/Stop via Terminal (FX/RX) |
|---|---|

**[Operation condition]**

-. Control mode : Speed control
-. Ref. Speed : 1500[rpm] setting via keypad
-. Accel/Decel time : Accel - 10[sec], Decel - 20[sec]
-. Run/Stop Src : Run/Stop via FX/RX terminal, Control terminal: NPN mode

**[Wiring]**




**[Related Function Code]**

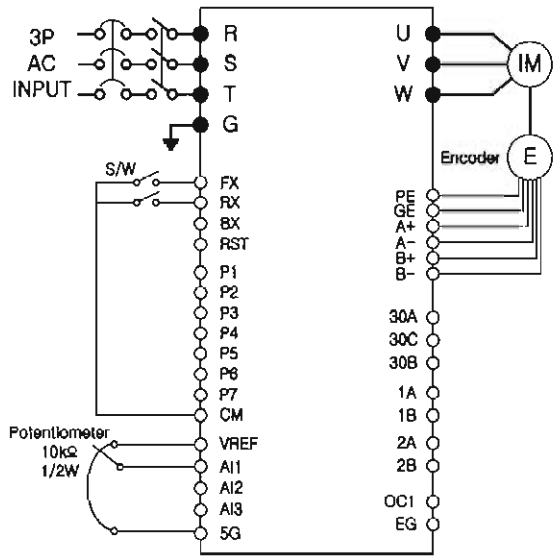
| Step | Parameter setting | Code | Description |
|---|---|---|---|
| 1 | RUN/STOP source select | FUN_01 | Set it to 0 "Terminal 1". |
| 2 | Speed setting method | FUN_02 | Set it to 1 "Keypad1". |
| 3 | Ref. Speed Setting | FUN_12 | Set speed command 1500[rpm] via Keypad. |
| 4 | Accel/Decel time | FUN_40<br>FUN_41 | Set Accel time to 10 [sec] in FUN_40.<br>Set Decel time to 20 [sec] in FUN_41. |
| 5 | Terminal FX | - | Motor starts to rotate in Forward direction at 1500[rpm] with Accel time 10 [sec] when FX terminal is turned ON.<br>Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF. |
| 6 | Terminal RX | - | When RX terminal is turned ON motor starts to rotate in Reverse direction at 1500[rpm] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec]. |

| Operation Example (2) | Analog Voltage Input(AI1) + Run/Stop via Terminal (FX/RX) |
|---|---|

**[Operation condition]**

-. Control mode : Speed control
-. Ref. Speed : 1500[rpm] analog input via AI1(Potentiometer)
-. Accel/Decel time : Accel - 10[sec], Decel - 20[sec]
-. Run/Stop Src : Run/Stop via FX/RX terminal, Control terminal: NPN mode

**[Wiring]**




**[Related Function Code]**

| Step | Parameter setting | Code | Description |
|---|---|---|---|
| 1 | RUN/STOP source select | FUN_01 | Set it to 0 "Terminal 1". |
| 2 | Speed setting method | FUN_02 | Set it to 0 "Analog". |
| 3 | Analog Input 1 Definition | AIO_01 | Set it to 1 "Speed Ref". |
| 4 | Analog Input 1 Input Method Definition | AIO_02 | Set it to 2 "0 → 10V". |
| 5 | Ref. Speed Setting | DIS_01 | Set speed command 1500[rpm] via AI1(Potentionmeter) in DIS_01 PreRamp Ref. |
| 4 | Accel/Decel time | FUN_40<br>FUN_41 | Set Accel time to 10 [sec] in FUN_40.<br>Set Decel time to 20 [sec] in FUN_41. |
| 6 | Terminal FX | - | Motor starts to rotate in Forward direction at 1500[rpm] with Accel time 10 [sec] when FX terminal is turned ON.<br>Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF. |
| 7 | Terminal RX | - | When RX terminal is turned ON motor starts to rotate in Reverse direction at 1500[rpm] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec]. |

# Chapter 5 - Function Code Table

## 5.1. Display Group (DIS_[][])

* " – " mark of communication adrress indicates communication exclusion.
* Setting during Inverter operation (Yes : possible, No : impossible)

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA RANGE | UNIT | DEFAULT | Adjustment During Run 1) | PAGE |
|---|---|---|---|---|---|---|---|---|
| DIS_00 | - | Motor Speed/Control Mode<br>Output Torque/Output Current | 0.0rpm SPD<br>Tq 0.0% 0.0A | | | | | |
| DIS_01 | - | User Display 1 | AI1 Value | | % | PreRamp Ref | Yes | 6-1 |
| | | | Ai2 Value | | % | | | |
| | | | Ai3 Value | | % | | | |
| | | | Ai4 Value 1) | | % | | | |
| | | | Ai5 Value 1) | | % | | | |
| | | | PreRamp Ref | | rpm | | | |
| | | | PostRamp Ref | | rpm | | | |
| | | | ASR Inp Ref | | rpm | | | |
| | | | Output Freq | | rpm | | | |
| | | | Motor Speed | | rpm | | | |
| | | | Speed Dev | | rpm | | | |
| | | | ASR Out | | % | | | |
| | | | Torque Bias | | % | | | |
| | | | PosTrq Limit | | % | | | |
| | | | NegTrq Limit | | - % | | | |
| | | | RegTrq Limit | | % | | | |
| | | | Torque Ref | | % | | | |
| | | | IqeRef | | A | | | |
| | | | Iqe | | A | | | |
| | | | Flux Ref | | % | | | |
| | | | Ide Ref | | A | | | |
| | | | Ide | | A | | | |
| | | | ACR_Q Out | | V | | | |
| | | | ACR_D Out | | V | | | |
| | | | VdeRef | | V | | | |
| | | | VqeRef | | V | | | |
| | | | Out Amps RMS | | A | | | |
| | | | Out Volt RMS | | V | | | |
| | | | Power | | kW | | | |
| | | | DC Bus Volt | | V | | | |
| | | | Proc PI Ref | | % | | | |
| | | | Proc PI F/B | | % | | | |
| | | | Proc PI Out | | % | | | |
| | | | MotTemp NTC | | deg | | | |
| | | | MotTemp PTC | | deg | | | |
| | | | Inv Temp | | deg | | | |
| | | | Inv i2t | | % | | | |
| | | | MP Output | | % | | | |
| | | | Ctrl Mode | | | | | |
| | | | S/W Version | | | | | |
| | | | Run Time | | | | | |
| | | | Terminal In | | | | | |
| | | | Terminal Out | | | | | |
| | | | Run Status | | | | | |
| | | | Diameter 2) | | % | | | |
| | | | Line SPD CMD 2) | | % | | | |
| | | | Reel SPD 2) | | % | | | |
| DIS_02 | - | User Display 2 | Refer to DIS_01 | | | DC Bus Volt | Yes | |
| DIS_03 | - | User Display 3 | Refer to DIS_01 | | | Terminal In | Yes | |
| DIS_04 | - | Process PID Output<br>Ref / FB | PIDOut 0.0%<br>*xx.x% 0.0% | | | | | 6-3 |
| DIS_05 | - | Faulty Display | Faults | | | | | |
| DIS_06 | 7106 | User Group Display Setting | Usr Grp Disp | 0 (Not Used)<br>1 (Dis+User Grp)<br>2 (Display ALL) | | 0 (Not Used) | Yes | 6-4 |

1) It is effective only when you use Extended I/O(EXTN_I/O).
2) It is displayed on WEB control Mode.

## 5.2 Digital DIO Group (DIO_[][])

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| DIO_00 | - | Jump for quick view | Jump Code | 1 ~ 75 | | | Yes | 6-5 |
| DIO_01 | 7201 | Multi-function input terminal P1 definition | P1 define | 0 (Not Used)<br>1 (Speed-L)<br>2 (Speed-M)<br>3 (Speed-H)<br>4 (Jog Speed)<br>5 (MOP Up)<br>6 (MOP Down)<br>7 (MOP Clear)<br>8 (MOP Save)<br>9 (Analog Hold)<br>10 (Main Drive)<br>11 (2nd Func)<br>12 (Xcel-L)<br>13 (Xcel-H)<br>14 (3-Wire)<br>15 (Ext Trip-B)<br>16 (Prohibit FWD)<br>17 (Prohibit REV)<br>18 (Proc PID Dis)<br>19 (Timer Input)<br>20 (SoftStrtCncl)<br>21 (ASR Gain Sel)<br>22 (ASR P/PI Sel)<br>23 (Flux Ref Sel)<br>24 (PreExcite)<br>25 (Spd/Trq Sel)<br>26 (Use Max Trq)<br>27 (Use Trq Bias)<br>30 (Battery Run) Note2)<br>41 (Dia Hold) Note1)<br>42 (Dia Preset) Note 1)<br>43 (CoreSize-L) Note 1)<br>44 (CoreSize-H) Note 1)<br>45(TensionDisable) Note 1)<br>46 (PI Gain Sel) Note 1)<br>47 (PID ITerm Clr) Note 1)<br>48 (Taper Disable) Note 1)<br>49 (Stall Enable) Note 1)<br>50 (Boost Enable) Note 1)<br>51 (Quick Stop) Note 1)<br>52 (Jog Web) Note 1)<br>53 (Under Wind) Note 1)<br>54 (Unwinder) Note 1) | | 0 (Not Used) | No | |
| DIO_02 | 7202 | Multi-function input terminal P2 definition | P2 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_03 | 7203 | Multi-function input terminal P3 definition | P3 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_04 | 7204 | Multi-function input terminal P4 definition | P4 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_05 | 7205 | Multi-function input terminal P5 definition | P5 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_06 | 7206 | Multi-function input terminal P6 definition | P6 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_07 | 7207 | Multi-function input terminal P7 definition | P7 define | Refer to DIO_1 | | 0 (Not Used) | No | |
| DIO_08 | - | Negative function of multi-function input terminal | Neg Func. In | 0000000 ~ 1111111 | bit | 0000000 | No | 6-16 |
| DIO_09 | 7209 | Multi-function Input LPF time constant | Terminal LPF | 0 ~ 2000 | | 5 | Yes | |
| DIO_10 | - | Negative function of multi-function auxillary output terminal | Neg Func. Out | 00000 ~ 11111 | bit | 00000 | No | 6-17 |

Note 1) It is displayed on WEB control Mode. Note 2) It is for only 5.5~22kW/2/4 products.

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| DIO_41 | 7229 | Definition of multi-function Auxiliary output (AX1) | AX1 Define | 0 (Not Used)<br>1 (INV Ready)<br>2 (Zero Spd Det)<br>3 (Spd Det.)<br>4 (Spd Det(ABS))<br>5 (Spd Arrival)<br>6 (Timer Out)<br>7 (LV Warn)<br>8 (Run)<br>9 (Regenerating)<br>10 (Mot OH Warn)<br>11 (Inv OH Warn)<br>12 (Spd Agree)<br>13 (Trq Det.)<br>14 (Trq Lmt Det.)<br>15 (OverLoad)<br>16 (Stop)<br>17 (Steady)<br>18 (Brake Output)<br>23 (WEB Break)[1]<br>24 (Up To Spd)[1]<br>25 (False Core)[1] | | 0 (Not Used) | Yes | 6-17 |
| DIO_42 | 722A | Definition of multi-function Auxiliary output (AX2) | AX2 Define | Same as DIO_41 | | 0 (Not Used) | Yes | |
| DIO_43 | 722B | Definition of multi-function Auxiliary output (OC1) | OC1 Define | Same as DIO_41 | | 0 (Not Used) | Yes | |
| DIO_46 | 722E | Fault relay mode selection (A, B, C) | Relay Mode | 000 ~ 111 | bit | 011 | Yes | 6-26 |
| DIO_47 | 722F | Zero speed detection level | ZSD Level | 0.0 ~ 480.0 | rpm | 10.0 | Yes | 6-19 |
| DIO_48 | 7230 | Zero speed detection band | ZSD Band | 0.1 ~ 10.0 | % | 0.5 | Yes | |
| DIO_49 | 7231 | Speed detection level | SD Level | -3600 ~ 3600 | rpm | 0 | Yes | 6-20 |
| DIO_50 | 7232 | Speed detection band | SD Band | 0.1 ~ 10.0 | % | 0.5 | Yes | |
| DIO_51 | 7233 | Speed arrival band | SA Band | 0.1 ~ 10.0 | % | 0.5 | Yes | 6-21 |
| DIO_52 | 7234 | Speed deviation band | SEQ Band | 0.1 ~ 10.0 | % | 0.5 | Yes | |
| DIO_53 | 7235 | Torque detection level | TD Level | 0.0 ~ 250.0 | % | 0.0 | Yes | 6-23 |
| DIO_54 | 7236 | Torque detection band | TD Band | 0.1 ~ 10.0 | % | 0.5 | Yes | |
| DIO_55 | 7237 | Timer On delay time | TimerOn Dly | 0.1 ~ 3600.0 | sec | 0.1 | Yes | 6-22 |
| DIO_56 | 7238 | Timer Off delay time | TimerOff Dly | 0.1 ~ 3600.0 | sec | 0.1 | Yes | |
| DIO_57 | 7239 | Overload warning level | OL Level | 30 ~ 250 | % | 150 | Yes | 6-24 |
| DIO_58 | 723A | Overload warning time | OL Time | 0 ~ 30 | sec | 10 | Yes | |
| DIO_59 | 723B | Overload trip selection | OLT Select | 0 (No)<br>1 (Yes) | | 1 (Yes) | Yes | 6-26 |
| DIO_60 | 723C | Overload trip level | OLT Level | 30 ~ 250 | % | 180 | Yes | |
| DIO_61 | 723D | Overload trip time | OLT Time | 0 ~ 60 | sec | 60 | Yes | |
| DIO_62 | 723E | Inverter overheat warning temp. | IH Warn Temp | 50 ~ 85 | deg | 75 | Yes | 6-23 |
| DIO_63 | 723F | Inverter overheat warning band | IH Warn Band | 0 ~ 10 | deg | 5 | Yes | |
| DIO_64 | 7240 | Motor overheat warning temp. | MH Warn Temp | 75 ~ 130 | deg | 120 | Yes | |
| DIO_65 | 7241 | Motor overheat warning band | MH Warn Band | 0 ~ 10 | deg | 5 | Yes | |
| DIO_97 | 7261 | How to Run at Lost command | Lost Command | 0 (None)<br>1 (FreeRun)<br>2 (Stop) | | 0 (None) | No | 6-26 |

1) Displayed WEB Control mode setting.

## 5.3 Parameter group (PAR_[][])

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| PAR_00 | - | Jump for quick view | Jump Code | 1 ~ 33 | | | Yes | 6-27 |
| PAR_01 | 7301 | Initialize parameters | Para. init | 0 (No) 1(All Groups)<br>2 (DIS) 3 (DIO)<br>4 (PAR) 5 (FUN)<br>6 (CON) 7 (EXT)<br>8 (AIO) 9 (USR)<br>10 (2ND) 11 (E/L)<br>12 (SYN) 13 (WEB) | | 0 (No) | No | |
| PAR_02 | - | Read parameters | Para. read | No / Yes | | No | No | |
| PAR_03 | - | Write parameters | Para. write | No / Yes | | No | No | |
| PAR_04 | - | Parameter write protection | Para. lock | 0 ~ 255 | | 0 | Yes | 6-28 |
| PAR_05 | - | Password | Password | 0 ~ 9999 | | 0 | Yes | |
| PAR_07 | 7307 | Motor capacity selection | Motor select | 0 (2.2) 1 (3.7)<br>2 (5.5) 3 (7.5)<br>4 (11.0) 5 (15.0)<br>6 (18.5) 7 (22.0)<br>8 (30.0) 9 (37.0)<br>10 (45.0) 11 (55.0)<br>12 (75.0) 13 (90.0)<br>14 (110.0) 15 (132.0)<br>16 (160.0) 17 (220.0)<br>18 (280.0) 19 (315.0)<br>20 (375.0)<br>21 (User Define) 1) | kW | | No | 6-29 |
| PAR_08 | 7308 | Motor cap. selection of USER | UserMotorSel | 1.5 ~ 375.0 | kW | 5.5 | No | |
| PAR_09 | 7309 | Motor cooling type | Cooling Mtd | 0 (Self-cool)<br>1 (Forced-cool) | | 1 (Forced-cool) | Yes | |
| PAR_10 | 730A | Pulse no. of encoder | Enc Pulse | 360 ~ 4096 | | 1024 | No | 6-30 |
| PAR_11 | 730B | Encoder direction setting | Enc Dir Set | 0 (A Phase Lead)<br>1 (B Phase Lead) | | 0 (A Phase Lead) | No | 6-29 |
| PAR_12 | 730C | Encoder error check enable | Enc Err Chk | 0 (No) / 1 (Yes) | | 1 (Yes) | No | 6-30 |
| PAR_13 | 730D | Encoder LPF time constant | Enc LPF | 0 ~ 100 | ms | 1 | Yes | |
| PAR_14 | 730E | Encoder error detection time | EncFaultTime | 0.00 ~ 10.00 | sec | 0.00 | No | |
| PAR_15 | 730F | encoder error reference speed | EncFaultPerc | 0.0 ~ 50.0 | % | 25.0 | No | |
| PAR_17 | 7311 | Motor base speed | Base Speed | 100.0 ~ 3600.0 | rpm | 1800.0 | No | 6-32 |
| PAR_18 | 7312 | Motor rated voltage | Rated Volt | 120 ~ 560 | V | | No | |
| PAR_19 | 7313 | Motor number of poles | Pole number | 2 ~ 12 | | 4 | Yes | |
| PAR_20 | 7314 | Motor efficiency | Efficiency | 70.0 ~ 100.0 | % | | Yes | |
| PAR_21 | 7315 | Motor rated slip | Rated-Slip | 10 ~ 250 | rpm | | Yes | |
| PAR_22 | 7316 | Motor rated current | Rated-Curr | 1.0 ~ 750.0 | A | | Yes | |
| PAR_23 | 7317 | Auto tuning type selection | AutoTuneType | 0 (Rotational)<br>1 (Standstill) | | 0 (Rotational) | No | 6-33 |
| PAR_24 | - | Auto tuning range setting 2) | Auto Tuning | None<br>ALL1/ALL2<br>Encoder Test<br>Rs Tuning<br>Lsigma<br>Flux Curr<br>Ls Tuning<br>Tr Tuning | | None | No | |
| PAR_25 | 7319 | Tuning Torque | Tune Torque | 10.0 ~ 100.0 | % | 70 | Yes | |
| PAR_26 | 731A | Motor flux current | Flux-Curr | 0.0 ~ PAR_22 의 70% | A | | Yes | 6-37 |
| PAR_27 | 731B | Motor time constant | Tr | 30 ~ 3000 | ms | | Yes | |
| PAR_28 | 731C | Leakage inductance | Ls | 0.00 ~ 500.00 | mH | | Yes | |
| PAR_29 | 731D | Leakage coefficient | Lsigma | 0.00 ~ 100.00 | mH | | Yes | |
| PAR_30 | 731E | Stator resistance | Rs | 0.000 ~ 5.000 | ohm | | Yes | |
| PAR_33 | 7321 | Encoder pulse multiplication 3) | Enc Scale | x1 / x16 / x32 / x64 | | x 1 | No | |

**1) When PAR_07 is set to "User Define", PAR_08 will be displayed.**

**2) If PAR_23 (Auto-tuning type select) is set to "Standstill", the order of display in PAR_24 (Auto-tuning range setting) will be None→ ALL1→ Rs Tuning→ Lsigma→ If/Tr/Ls Tune.**

**3) Caution :PAR 33 Code is necessary only in the case of installation of SIN/COS Encoder option board. Don't modify the default value "X1" when not using SIN/COS Encoder board If you modify the value, the normal operation isn't possible. For any extra information in detail, refer to the option dedicated manual.**

## 5.4. Function group (FUN_[][])

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| FUN_00 | - | Jump for quick view | Jump code | 1 ~ 69 | | | Yes | 6-39 |
| FUN_01 | 7401 | RUN/STOP command source selection | Run/Stop Src | 0 (Terminal 1)<br>1 (Terminal 2)<br>2 (Keypad)<br>3 (Option) | | 0 (Terminal 1) | No | |
| FUN_02 | 7402 | Speed setting source selection | Spd Ref Sel | 0 (Analog)<br>1 (Keypad1)<br>2 (Keypad2)<br>3 (Option)<br>6 (Line SPD Ref) 1)<br>7 (Line SPD Opt) 1) | | 1 (Keypad1) | No | 6-40 |
| FUN_03 | 7403 | Stop mode selection | Stop mode | 0 (Decel)<br>1 (Free-run) | | 0 (Decel) | No | |
| FUN_04 | 7404 | Max. motor speed | Max Speed | 400.0 ~ 3600.0 | rpm | 1800.0 | No | |
| FUN_12 | 740C | Multi-step speed 0 | Speed 0 | 0.0~Max Speed | rpm | 0.0 | Yes | 6-41 |
| FUN_13 | 740D | Multi-step speed 1 | Speed 1 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_14 | 740E | Multi-step speed 2 | Speed 2 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_15 | 740F | Multi-step speed 3 | Speed 3 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_16 | 7410 | Multi-step speed 4 | Speed 4 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_17 | 7411 | Multi-step speed 5 | Speed 5 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_18 | 7412 | Multi-step speed 6 | Speed 6 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_19 | 7413 | Multi-step speed 7 | Speed 7 | 0.0~Max Speed | rpm | 0.0 | Yes | |
| FUN_20 | 7414 | JOG speed | Jog Speed | 0.0~Max Speed | rpm | 100.0 | Yes | |
| FUN_21 | 7415 | Dwell Speed | Dwell Speed | 0.0~Max Speed | rpm | 100.0 | No | |
| FUN_22 | 7416 | Dwell Time | Dwell Time | 0.00 ~ 100.00 | sec | 0.00 | No | |
| FUN_33 | 7421 | Acc./Dec. reference Speed | Acc/Dec Ref | 0 (Max Speed)<br>1 (Ref Speed) | | 0 (Max Speed) | No | 6-42 |
| FUN_36 | 7424 | S ratio 1 in acceleration start | Acc S Start | 0.0 ~ 50.0 | % | 0.0 | No | 6-43 |
| FUN_37 | 7425 | S ratio 2 in acceleration start | Acc S End | 0.0 ~ 50.0 | % | 0.0 | No | |
| FUN_38 | 7426 | S ratio 1 in acceleration start | Dec S Start | 0.0 ~ 50.0 | % | 0.0 | No | |
| FUN_39 | 7427 | S ratio 2 in acceleration start | Dec S End | 0.0 ~ 50.0 | % | 0.0 | No | |
| FUN_40 | 7428 | Acceleration time 1 | Acc Time-1 | 0.00 ~ 6000.0 | sec | 2.00 | Yes | 6-42 |
| FUN_41 | 7429 | Deceleration time 1 | Dec Time-1 | 0.00 ~ 6000.0 | sec | 2.00 | Yes | |
| FUN_42 | 742A | Acceleration time 2 | Acc Time-2 | 0.00 ~ 6000.0 | sec | 3.00 | Yes | |
| FUN_43 | 742B | Deceleration time 2 | Dec Time-2 | 0.00 ~ 6000.0 | sec | 3.00 | Yes | |
| FUN_44 | 742C | Acceleration time 3 | Acc Time-3 | 0.00 ~ 6000.0 | sec | 4.00 | Yes | |
| FUN_45 | 742D | Deceleration time 3 | Dec Time-3 | 0.00 ~ 6000.0 | sec | 4.00 | Yes | |
| FUN_46 | 742E | Acceleration time 4 | Acc Time-4 | 0.00 ~ 6000.0 | sec | 5.00 | Yes | |
| FUN_47 | 742F | Deceleration time 4 | Dec Time-4 | 0.00 ~ 6000.0 | sec | 5.00 | Yes | |
| FUN_48 | 7430 | Deceleration time selection for zero speed | Use 0 Dec T | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 6-45 |
| FUN_49 | 7431 | Deceleration time for zero speed | 0 Dec Time | 0.00 ~ 6000.0 | sec | 0.00 | Yes | |
| FUN_51 | 7433 | Deceleration time for emergency stop | BX Time | 0.0 ~ 6000.0 | sec | 0.0 | Yes | 6-46 |
| FUN_52 | 7434 | Pre-excitation time | PreExct Time | 0 ~ 10000 | ms | 0 | No | |
| FUN_53 | 7435 | Hold Time | Hold Time | 100 ~ 10000 | ms | 1000 | No | |
| FUN_54 | 7436 | Electronic thermal selection | ETH Select | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 6-47 |

1) Displayed when setting WEB Control Mode.

| Code No. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| FUN_55 | 7437 | Electronic thermal level for 1 minute | ETH 1 min | FUN_56 ~ 200 | % | 150 | Yes | 6-47 |
| FUN_56 | 7438 | Electronic thermal level for continuous | ETH Cont | 50 ~ FUN_55 (up to 150%) | % | 100 | Yes | |
| FUN_57 | 7439 | Switching frequency select | PWM Freq | 2.5 ~ 10.0 | kHz | Different according to the capacity of inverter | No | 6-48 |
| FUN_58 | 743A | Power on Run selection | Power-on Run | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 6-49 |
| FUN_59 | 743B | Restart after fault reset | RST Restart | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 6-50 |
| FUN_60 | 743C | Number of auto restart try | Retry Number | 0 ~ 10 | | 0 | Yes | 6-51 |
| FUN_61 | 743D | Delay time before Auto restart | Retry Delay | 0.0 ~ 60.0 | sec | 1.0 | Yes | |
| FUN_62 | 743E | Wait time for Restart upon Stop | Restart Time | 0.00 ~ 10.00 | sec | 0.00 | No | 6-52 |
| FUN_63 | 743F | Overspeed Detection Level | OverSpdLevel | 100.0 ~ 130.0 | % | 120.0 | No | |
| FUN_64 | 7440 | Overspeed Detection Time | OverSpd Time | 0.00 ~ 2.00 | sec | 0.00 | No | |
| FUN_65 | 7441 | Brake Open Time Note 1) | BKOpen Time | 0.00 ~ 30.00 | sec | 0.00 | No | 6-53 |
| FUN_66 | 7442 | Brake Open Speed Note 1) | BKOpen Spd | 0.0 ~ 500.0 | rpm | 0.0 | No | |
| FUN_67 | 7443 | Brake Open Current Note 1) | Release Curr | 0.0 ~ 150.0 | % | 20.0 | No | |
| FUN_68 | 7444 | Brake Close Time Note 1) | BKClose Time | 0.00 ~ 30.00 | sec | 0.00 | No | |
| FUN_69 | 7445 | Brake Close Speed Note 1) | BKClose Spd | 0.0 ~ 500.0 | rpm | 0.0 | No | |
| FUN_70 | 7446 | Speed in battery-operated mode Note 2) | Batt. Speed | 2.5 ~ 200.0 | rpm | 50.0 | No | 6-55 |
| FUN_71 | 7447 | Battery input voltage Note 2) | Batt. Volt | 12 ~ PAR_18 | V | 48 | No | 6-55 |

Note 1) Displayed when setting the definition of multi-aux output terminal (DIO_41~DIO_43) as "Brake Output".

Note2) It can set for only 5.5 ~ 22 kW/2/4 products in case 'Battery Run' of multi-function input terminal (P1 ~ P&) is turned On.

## 5.5. Control group (CON_[][])

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| CON_00 | - | Jump for quick view | Jump Code | 1 ~ 49 | | | Yes | 6-55 |
| CON_01 | 7501 | Control mode setting | Control Mode | 1 (Speed)<br>2 (Torque) | | 1 (Speed) | No | |
| CON_02 | - | Application mode setting | Application | General Vect<br>Elevator [1]<br>Synchro[2]<br>WEB Control | | General Vect | No | |
| CON_03 | 7503 | ASR P Gain 1 | ASR P Gain1 | 0.1 ~ 200.0 | % | 50.0 | Yes | 6-56 |
| CON_04 | 7504 | ASR I Gain 1 | ASR I Gain1 | 0 ~ 50000 | ms | 300 | Yes | |
| CON_05 | 7505 | ASR LPF time constant 1 | ASR LPF1 | 0 ~ 20000 | ms | 0 | Yes | |
| CON_06 | 7506 | ASR P Gain 2 | ASR P Gain2 | 0.1 ~ 200.0 | % | 5.0 | Yes | |
| CON_07 | 7507 | ASR I Gain 2 | ASR I Gain2 | 0 ~ 50000 | ms | 3000 | Yes | |
| CON_08 | 7508 | ASR LPF time constant 2 | ASR LPF2 | 0 ~ 20000 | ms | 0 | Yes | |
| CON_09 | 7509 | Ramp time for ASR gain switch-over | ASR RAMP | 10 ~ 10000 | ms | 1000 | Yes | 6-57 |
| CON_10 | 750A | Target Speed after ASR gain switch-over | ASR TarSpd | 0.0 ~ 3600.0 | rpm | 0.0 | No | |
| CON_11 | 750B | Process PID reference (keypad) | Proc PID Ref | -100.0 ~ 100.0 | % | 0.0 | Yes | 6-58 |
| CON_13 | 750D | Process PID P gain | Proc PID Kp | 0.0 ~ 999.9 | % | 0.0 | Yes | 6-59 |
| CON_14 | 750E | Process PID I gain | Proc PID Ki | 0.0 ~ 100.0 | % | 0.0 | Yes | |
| CON_15 | 750F | Process PID D gain | PROC PID Kd | 0.0 ~ 100.0 | % | 0.0 | Yes | |
| CON_16 | 7510 | Process PID Positive limit | Proc Pos Lmt | -100.0 ~ 100.0 | % | 100 | Yes | |
| CON_17 | 7511 | Process PID Negative limit | Proc Neg Lmt | -100.0 ~ 100.0 | % | 100 | Yes | |
| CON_18 | 7512 | Process PID output LPF time constant | Proc Out LPF | 0 ~ 500 | ms | 0 | Yes | |
| CON_19 | 7513 | Process PID output gain | Proc OutGain | -250.0 ~ 250.0 | % | 0.0 | Yes | |
| CON_20 | 7514 | Process PID output Enable | Proc PID Enb | 0 (Disable)<br>1 (Enable)<br>2 (Terminal) | | 0 (Disable) | No | |
| CON_21 | 7515 | Proces PID Hold Time | PIDHoldTime | 0 ~ 10000 | ms | 5000 | No | 6-59 |
| CON_22 | 7516 | Draw quantity | Draw % | -100.0 ~ 100.0 | % | 0.0 | Yes | 6-61 |
| CON_23 | 7517 | Droop quantity | Droop % | 0.0 ~ 100.0 | % | 0.0 | Yes | 6-62 |
| CON_24 | 7518 | Low speed limit of Droop control | Droop MinSpd | 0.0 ~ 3600.0 | rpm | 0.0 | Yes | |
| CON_25 | 7519 | Starting torque of Droop control | Droop MinTrq | 0.0 ~ 100.0 | % | 0.0 | Yes | |
| CON_26 | 751A | Torque reference source selection | Trq Ref Src | 0 (None)<br>1 (Analog)<br>2 (Keypad)<br>3 (Option) | | 0 (None) | No | 6-64 |
| CON_27 | 751B | Torque Reference(keypad) | Torque Ref | -180.0 ~ 180.0 | % | 0.0 | Yes | |
| CON_28 | 751C | Torque limit source selection | Trq Lmt Src | 0 (Kpd Kpd Kpd)<br>1 (Kpd Kpd Ax)<br>2 (Kpd Ax Kpd)<br>3 (Kpd Ax Ax)<br>4 (Ax Kpd Kpd)<br>5 (Ax Kpd Ax)<br>6 (Ax Ax Kpd)<br>7 (Ax Ax Ax)<br>8 (Opt Opt Opt) | | 0 (Kpd Kpd Kpd) | No | 6-66 |
| CON_29 | 751D | Torque limit in forward run | Pos Trq Lmt | 0.0 ~ 250.0 | % | 150.0 | Yes | |
| CON_30 | 751E | Torque limit in reverse run | Neg Trq Lmt | 0.0 ~ 250.0 | % | 150.0 | Yes | |
| CON_31 | 751F | Torque limit in regeneration | Reg Trq Lmt | 0.0 ~ 250.0 | % | 150.0 | Yes | |
| CON_32 | 7520 | Torque Bias source selection | Trq Bias Src | 0 (None)<br>1 (Analog)<br>2 (Keypad)<br>3 (Option) | | 0 (None) | No | 6-65 |
| CON_33 | 7521 | Torque Bias quantity | Trq Bias | -150.0 ~ 150.0 | % | 0.0 | Yes | |
| CON_34 | 7522 | Torque bias feedforward | Trq Bias FF | -150.0 ~ 150.0 | % | 0.0 | Yes | |
| CON_35 | 7523 | Torque Balance quantity | Trq Balance | 0.0 ~ 100.0 | % | 50.0 | Yes | |
| CON_49 | 7531 | Speed search setting | Speed Search | 0000 ~ 1111<br>(bit setting) | | 0100 | No | 6-68 |

1) Displayed only when the E/L_IO board is installed.

2) Displayed only when the SYNC_IO board is installed.

## 5.6. User group (USR_[][])

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| USR_00 | - | Select Code number | Jump Code | 1 ~ 67 | | | Yes | 6-69 |
| USR_01 | - | Initialize to the initial value adequate to the application | Macro Init | User Define E/L | | User Define | No | |
| USR_02 | - | User data save | User Save | No / Yes | | No | No | |
| USR_03 | - | Recall saved User Data. | User Recall | No / Yes | | No | No | |
| USR_04 | - | User Group Data | User Grp | | | | No | |

## 5.7. Second motor function (2nd_[][])

| CODE NO. | Comm. Addr | CODE NAME | LCD DISPLAY | SETTING DATA | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | RANGE | UNIT | DEFAULT | | |
| 2nd_00 | - | Jump for quick view | Jump Code | 1 ~ 33 | | | Yes | 6-71 |
| 2nd_01 | 7801 | 2nd motor Control mode setting | 2nd Ctl Mode | 1 (Speed) 2 (Torque) | | 1 (Speed) | No | |
| 2nd_02 | 7802 | Max. speed of 2nd motor | 2nd Max Spd | 400.0 ~ 3600.0 | rpm | 1800.0 | No | |
| 2nd_04 | 7804 | Multi-step speed 0 of 2nd motor | 2nd Spd 0 | 0.0 ~ 2nd_02 | rpm | 0.0 | Yes | |
| 2nd_05 | 7805 | 2nd motor S ratio 1 in acceleration start | 2nd Acc S St | 0.0 ~ 50.0 | % | 0.0 | No | 6-72 |
| 2nd_06 | 7806 | 2nd motor S ratio 2 in acceleration end | 2nd Acc S Ed | 0.0 ~ 50.0 | % | 0.0 | No | |
| 2nd_07 | 7807 | 2nd motor S ratio 1 in deceleration start | 2nd Dec S St | 0.0 ~ 50.0 | % | 0.0 | No | |
| 2nd_08 | 7808 | 2nd motor S ratio 2 in deceleration end | 2nd Dec S Ed | 0.0 ~ 50.0 | % | 0.0 | No | |
| 2nd_09 | 7809 | acceleration time of 2nd motor | 2nd Acc time | 0.00 ~ 6000.0 | sec | 10.00 | Yes | |
| 2nd_10 | 780A | deceleration time of 2nd motor | 2nd Dec time | 0.00 ~ 6000.0 | sec | 10.00 | Yes | |
| 2nd_11 | 780B | cooling method of 2nd motor | 2nd Cool Mtd | 0 (Self-cool) 1 (Forced-cool) | | 0 (Self-cool) | Yes | |
| 2nd_12 | 780C | Encoder pulse no. of 2nd motor | 2nd Enc # | 360 ~ 4096 | | 1024 | No | |
| 2nd_13 | 780D | Encoder direction setting of 2nd motor | 2nd Enc Dir | 0 (A Phase Lead) 1 (B Phase Lead) | | 0 (A Phase Lead) | No | |
| 2nd_14 | 780E | Encoder error check enable of 2nd motor | 2nd Enc chk | 0 (No) 1 (Yes) | | 1 (Yes) | No | |
| 2nd_15 | 780F | Encoder LPF time constant of 2nd motor | 2nd Enc LPF | 0 ~ 100 | ms | 1 | Yes | |
| 2nd_17 | 7811 | Base speed of 2nd motor | 2nd BaseSpd | 300.0 ~ 3600.0 | rpm | 1800.0 | No | |
| 2nd_18 | 7812 | Rated voltage of 2nd motor | 2nd R-Volt | 120 ~ 560 | V | | No | |
| 2nd_19 | 7813 | 2nd motor number of poles | 2nd Pole # | 2 ~ 12 | | 4 | No | |
| 2nd_20 | 7814 | Efficiency of 2nd motor | 2nd Mot Eff. | 70 ~ 100 | % | | Yes | |
| 2nd_21 | 7815 | Rated slip of 2nd motor | 2nd R-Slip | 10 ~ 250 | rpm | | Yes | |
| 2nd_22 | 7816 | Rated current of 2nd motor | 2nd R-Curr | 1.0 ~ 450.0 | A | | Yes | |
| 2nd_23 | 7817 | Flux current of 2nd motor | 2nd Flx Cur | 0.0 ~ 70% of 2nd_22 | A | | Yes | |
| 2nd_24 | 7818 | Rotor time constant of 2nd motor | 2nd Mot Tr | 30 ~ 3000 | ms | | Yes | |
| 2nd_25 | 7819 | Leakage inductance of 2nd motor | 2nd Mot Ls | 0.00 ~ 500.00 | mH | | Yes | |
| 2nd_26 | 781A | Leakage coefficient of 2nd motor | 2nd Mot sLs | 0.00 ~ 100.00 | mH | | Yes | |
| 2nd_27 | 781B | Stator resistance Of 2nd motor | 2nd Mot Rs | 0.000 ~ 5.000 | ohm | | Yes | |
| 2nd_32 | 7820 | Electronic thermal level for 1 minute of 2nd motor | 2nd ETH 1min | 100 ~ 150 | % | 150 | Yes | |
| 2nd_33 | 7821 | Electronic thermal continuous level of 2nd motor | 2nd ETH cont | 50 ~ 150 | % | 100 | Yes | |

## 5.8. Analog AIO Group (AIO_[][])

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| AIO_00 | - | Select code number | Jump Code | 1 ~ 79 | | | Yes | 6-73 |
| AIO_01 | 7701 | Multi-function Analog Input Ai1 definition | Ai1 Define | 0 (Not Used)<br>1 (Speed Ref)<br>2 (Proc PID Ref)<br>3 (Proc PID F/B)<br>4 (Draw Ref)<br>5 (Torque Ref)<br>6 (Flux Ref)<br>7 (Torque Bias)<br>8 (Torque Limit)<br>9 (Line SPD Ref) 1)<br>10 (Tension Ref) 1)<br>11 (Dancer Ref) 1)<br>12 (Taper Ref) 1)<br>13 (Tension F/B) 1)<br>14 (Diameter) 1)<br>15 (Diam Preset) 1) | | 0 (Not Used) | Yes | |
| AIO_02 | 7702 | Multi-function Analog Input Ai1 Source definition | Ai1 Source | 0 (-10 → 10V)<br>1 (10 → -10V)<br>2 (0 → 10V)<br>3 (10 → 0V)<br>4 (0 → 20mA)<br>5 (20 → 0mA) | | 0 (-10 → 10V) | Yes | |
| AIO_03 | 7703 | Multi-function Analog Input Ai1 Minimum Voltage | Ai1 In X1 | 0.00 ~ Ai1 In X2 | % | 0.00 | Yes | |
| AIO_04 | 7704 | Multi-function Analog Input Ai1 Minimum Voltage Bias | Ai1 Out Y1 | -10.00 ~ Ai1 Out Y2 | % | 0.00 | Yes | |
| AIO_05 | 7705 | Multi-function Analog Input Ai1 Maximum Voltage | Ai1 In X2 | 0.00 ~ 100.00 | % | 100.00 | Yes | |
| AIO_06 | 7706 | Multi-function Analog Input Ai1 Maximum Voltage Gain | Ai1 Out Y2 | 0.00 ~ 250.00 | % | 100.00 | Yes | |
| AIO_07 | 7707 | Multi-function Analog Input Ai1 -Minimum Voltage | Ai1 -In X1 | Ai1 -In X2 ~ 0.00 | % | 0.00 | Yes | |
| AIO_08 | 7708 | Multi-function Analog Input Ai1 -Minimum Voltage Bias | Ai1 -Out Y1 | Ai1 -Out Y2 ~ 10.00 | % | 10.00 | Yes | |
| AIO_09 | 7709 | Multi-function Analog Input Ai1-Maximum Voltage | Ai1 -In X2 | -100.00 ~ 0.00 | % | -100.00 | Yes | |
| AIO_10 | 770A | Multi-function Analog Input Ai1-Maximum Voltage Gain | Ai1 -Out Y2 | -250.00 ~ 0.00 | % | -100.00 | Yes | |
| AIO_11 | 770B | Ai1 input LPF time constant | Ai1 LPF | 0 ~ 2000 | ms | | | |
| AIO_12 | 770C | Multi-function Analog Input Ai1 command loss Criterion select | Ai1 Wbroken | 0 (None)<br>1 (Half of x1)<br>2 (Below x1) | | 0 (None) | No | |

**1) Displayed only when WEB mode setting.**

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| AIO_13 | 770D | Multi-function Analog input Ai2 Definition | Ai2 Define | Refer to AIO_01~12 | | | | 6-73 |
| AIO_14 | 770E | Multi-function Analog Input Ai2 Source definition | Ai2 Source | | | | | |
| AIO_15 | 770F | Multi-function Analog input Ai2 Minimum Voltage | Ai2 In X1 | | | | | |
| AIO_16 | 7710 | Multi-function Analog input Ai1 Minimum Voltage Bias | Ai2 Out Y1 | | | | | |
| AIO_17 | 7711 | Multi-function Analog input Ai2 Maximum Voltage | Ai2 In X2 | | | | | |
| AIO_18 | 7712 | Multi-function Analog input Ai2 Maximum Voltage Gain | Ai2 Out Y2 | | | | | |
| AIO_19 | 7713 | Multi-function Analog input Ai2 -Minimum Voltage | Ai2 -In X1 | | | | | |
| AIO_20 | 7714 | Multi-function Analog input Ai2 -Minimum Voltage Bias | Ai2 -Out Y1 | | | | | |
| AIO_21 | 7715 | Multi-function Analog input Ai2 -Maximum Voltage | Ai2 -In X2 | | | | | |
| AIO_22 | 7716 | Multi-function Analog Input Ai2 -Maximum Voltage Gain | Ai2 -Out Y2 | | | | | |
| AIO_23 | 7717 | Ai2 input LPF time constant | Ai2 LPF | | | | | |
| AIO_24 | 7718 | Multi-function Analog Input Ai2 loss command Criterion select | Ai2 Wbroken | | | | | |
| AIO_25 | 7719 | Multi-function Analog input Ai3 Definition | Ai3 Define | Refer to AIO_01<br>∫<br>Possible to select NTC/PTC motor<br>16 (Use Mot NTC)<br>17 (Use Mot PTC) | | 0 (Not Used) | Yes | |
| AIO_26 | 771A | Multi-function Analog Input Ai3 Source Definition | Ai3 Source | 0 (-10 → 10V)<br>1 (10 → -10V)<br>2 (0 → 10V)<br>3 (10 → 0V) | | 0 (-10 → 10V) | Yes | |
| AIO_27 | 771B | Multi-function Analog Input Ai3 Minimum Voltage | Ai3 In X1 | Refer to AIO_03~12 | | | | |
| AIO_28 | 771C | Multi-function Analog Input Ai3 Minimum Voltage Bias | Ai3 Out Y1 | | | | | |
| AIO_29 | 771D | Multi-function Analog input Ai3 Maximum Voltage | Ai3 In X2 | | | | | |
| AIO_30 | 771E | Multi-function Analog Input Ai3 Maximum Voltage Gain | Ai3 Out Y2 | | | | | |
| AIO_31 | 771F | Multi-function Analog Input Ai3 -Minimum Voltage | Ai3 -In X1 | | | | | |
| AIO_32 | 7720 | Multi-function Analog input Ai3 –Minimum Voltage Bias | Ai3 -Out Y1 | | | | | |
| AIO_33 | 7721 | Multi-function Analog input Ai3 -Maximum Voltage | Ai3 -In X2 | | | | | |

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| AIO_34 | 7722 | Multi-function Analog input Ai3 -Maximum Voltage Gain | Ai3 -Out Y2 | Refer to AIO_01~12 | | | | 6-73 |
| AIO_35 | 7723 | Ai3 input LPF time constant | Ai3 LPF | | | | | |
| AIO_36 | 7724 | Multi-function Analog input Command loss criterion select | Ai3 Wbroken | | | | | |
| AIO_37 | 7725 | Multi-function Analog input Ai4 Definition 1) | Ai4 Define | | | | | |
| AIO_38 | 7726 | Multi-function Analog input Ai4 Source Definition 1) | Ai4 Source | | | | | |
| AIO_39 | 7727 | Multi-function Analog input Ai4 Minimum Voltage 1) | Ai4 In X1 | | | | | |
| AIO_40 | 7728 | Multi-function Analog Input Ai4 Minimum Voltage Bias 1) | Ai4 Out Y1 | | | | | |
| AIO_41 | 7729 | Multi-function Analog input Ai4 Maximum Voltage 1) | Ai4 In X2 | | | | | |
| AIO_42 | 772A | Multi-function Analog input Ai4 Maximum Voltage Gain 1) | Ai4 Out Y2 | | | | | |
| AIO_43 | 772B | Multi-function Analog input Ai4 -Minimum Voltage 1) | Ai4 -In X1 | | | | | |
| AIO_44 | 772C | Multi-function Analog Input Ai4 -Minimum Voltage Bias 1) | Ai4 -Out Y1 | | | | | |
| AIO_45 | 772D | Multi-function Analog input Ai4 -Maximum Voltage 1) | Ai4 -In X2 | | | | | |
| AIO_46 | 772E | Multi-function Analog input Ai4 -Maximum Voltage Gain 1) | Ai4 -Out Y2 | | | | | |
| AIO_47 | 772F | Ai4 output LPF time constant 1) | Ai4 LPF | | | | | |
| AIO_48 | 7730 | Multi-function Analog input Ai4 command loss criterion select 1) | Ai4 Wbroken | | | | | |
| AIO_49 | 7731 | Multi-function Analog Input Ai5 Definition 1) | Ai5 Define | Refer to AIO_01<br>I<br>When using EXTN_I/O motor NTC/PTC function is available at Ai5<br>16 (Use Mot NTC)<br>17 (Use Mot PTC) | | 0 (Not Used) | Yes | |
| AIO_50 | 7732 | Multi-function Analog Input Ai5 Source Definition 1) | Ai5 Source | 0 (-10 → 10V)<br>1 (10 → -10V)<br>2 (0 → 10V)<br>3 (10 → 0V) | | 0 (-10 → 10V) | Yes | |

**1) It only comes under using EXTN_I/O.**

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| AIO_51 | 7733 | Multi-function Analog input Ai5 Minimum Voltage [1] | Ai5 In X1 | Refer to AIO_03~12 | | | | 6-73 |
| AIO_52 | 7734 | Multi-function Analog input Ai4 Minimum Voltage Bias [1] | AI5 Out Y1 | | | | | |
| AIO_53 | 7735 | Multi-function Analog input AI5 Maximum Voltage [1] | Ai5 In X2 | | | | | |
| AIO_54 | 7736 | Multi-function Analog input AI5 Maximum Voltage Gain [1] | AI5 Out Y2 | | | | | |
| AIO_55 | 7737 | Multi-function Analog input Ai5 -MInimum Voltage [1] | Ai5 -In X1 | | | | | |
| AIO_56 | 7738 | Multi-function Analog input AI5 -MInimum Voltage Bias [1] | AI5 -Out Y1 | | | | | |
| AIO_57 | 7739 | Multi-function Analog input Ai5 -Maximum Voltage [1] | Ai5 -In X2 | | | | | |
| AIO_58 | 773A | Multi-function Analog input Ai5 -Maximum Voltage Gain [1] | AI5 -Out Y2 | | | | | |
| AIO_59 | 773B | Ai5 input LPF time constant[1] | Ai5 LPF | | | | | |
| AIO_60 | 773C | Multi-function Analog Input Ai5 command loss criterion select[1] | Ai5 Wbroken | | | | | |
| AIO_73 | 7749 | Multi-function Analog input command loss time | Time out | 0.1 ~ 120.0 | sec | 1.0 | No | 6-78 |
| AIO_74 | 774A | Multi-function analog Output AO1 Definition | AO1 Define | 0 (Not Used)<br>1 (Ai1 Value)<br>2 (AI2 Value)<br>3 (AI3 Value)<br>4 (Ai4 Value) [1]<br>5 (Ai5 Value) [1]<br>7 (PreRamp Ref)<br>8 (PostRamp Ref)<br>9 (ASR Inp Ref)<br>11 (Motor Speed)<br>12 (Speed Dev)<br>13 (ASR Out)<br>14 Torque Bias<br>15 (PosTrq Limit)<br>16 (NegTrq Limit)<br>17 (RegTrq Limit)<br>18 (Torque Ref)<br>19 (IqeRef)<br>20 (Iqe)<br>21 (Flux Ref)<br>22 (IdeRef)<br>23 (Ide)<br>24 (ACR_Q Out)<br>25 (ACR_D Out)<br>26 (VdeRef)<br>27 (VqeRef)<br>28(Out Amps RMS)<br>29 (Out Volt RMS)<br>30 (Power)<br>31 (DC Bus Volt)<br>32 (Proc PI Ref) | | 0 (Not Used) | Yes | 6-79 |

**1) It only comes under using EXTN_I/O.**

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| AIO_74 | 774A | Multi-function Analog Output AO1 Definition | AO1 Define | 33 (PROC PI F/B)<br>34 (Proc PI Out)<br>35 (Line Speed) 1)<br>36 (Tension Out) 1)<br>37 (Diameter) 1)<br>38 (MotNTC Temp)<br>39 (MotPTC Temp)<br>40 (Inv Temp)<br>41 (Inv i2t) | | 0 (Not Used) | Yes | 6-79 |
| AIO_75 | 774B | Multi-function Analog Output AO1 Source Definition | AO1 Source | 0 (-10 → 10V)<br>1 (10 → -10V)<br>2 (0 → 10V)<br>3 (10 → 0V) | | 0 (-10 → 10V) | No | |
| AIO_76 | 774C | Multi-function Analog Output AO1 Bias | AO1 Bias | -100.0 ~ AIO_77 | % | 0.0 | No | |
| AIO_77 | 774D | Multi-function Analog Output AO1 Gain | AO1 Gain | 0.0 ~ 500.0 | % | 100.0 | No | |
| AIO_78 | 774E | Multi-function Analog Output AO1 absolute value setting | AO1 ABS | 0 (No) / 1 (Yes) | | 0 (No) | No | |
| AIO_79 | 774F | Multi-function Analog Output AO2 Definition | AO2 Define | Refer to AIO_74~78 | | | | |
| AIO_80 | 7750 | Multi-function Analog Output AO2 Source Definition | AO2 Source | | | | | |
| AIO_81 | 7751 | Multi-function Analog Output AO2 Bias | AO2 Bias | | | | | |
| AIO_82 | 7752 | Multi-function Analog Output AO2 Gain | AO2 Gain | | | | | |
| AIO_83 | 7753 | Multi-function Analog Output AO1 absolute value setting | AO2 ABS | | | | | |

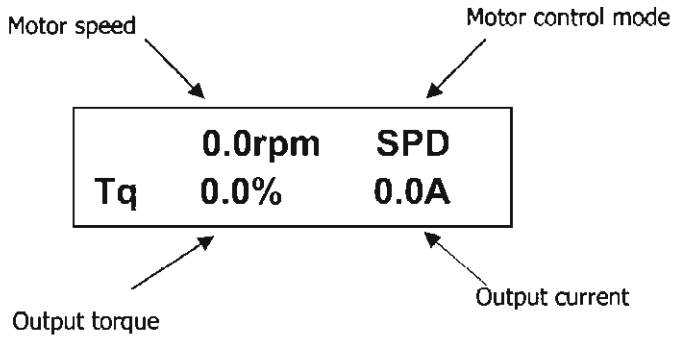
**1) Displayed only when WEB mode setting.**

# Chapter 6 – Function Description

## 6.1 Display Group (DIS_[][])

### 6.1.1 DIS_00 (Motor control status monitoring)

Displayed when Power ON.




| Code | Parameter name | Unit | Description |
|---|---|---|---|
| DIS_00 | Motor speed | rpm | Actual motor rotating speed displayed in rpm. |
| | Motor control mode | | SPD : Speed control mode<br>TRQ : Torque control mode<br>WEB : WEB control mode<br>BX : Emergency stop display<br>BAT : Battery-operated mode |
| | Output torque | % | 100% = Rated torque of motor |
| | Inverter output current | A | Inverter actual output current displayed |

### 6.1.2 DIS_01 ~ 03 (User display 1, 2, 3)

Select one of the followings each to be displayed in DIS_01, 02 and 03.

Factory default: **DIS_01= " PreRamp Ref ", DIS_02= "DC Bus Volt", DIS_03= " Terminal In "**

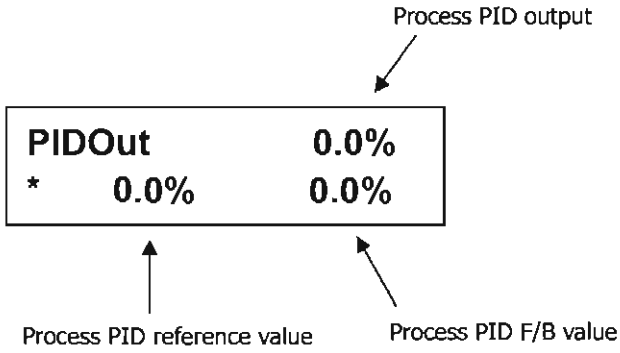
| Code | Parameter name | LCD display | Unit | Description |
|---|---|---|---|---|
| DIS_01 ~ DIS_03 | Ai1 Value ~ Ai3 Value *1 | Ai1 Value ~ Ai3 Value | % | Displayed as the percentage of multi-function analog input value (10V / 100%, 20mA / 100%) |
| | Pre Ramp Reference | PreRamp Ref | rpm | Speed reference before ramping |
| | Post ramp reference | PostRamp Ref | rpm | Speed reference after ramping |
| | ASR Input Reference | ASR Inp Ref | rpm | Final speed reference input value to ASR (Automatic Speed Regulator) displayed (Draw and Droop included) |
| | Motor Rotating Speed | Motor Speed | rpm | Actual motor rotating speed |
| | Speed Deviation | Speed Dev | rpm | Deviation between speed ref and actual rotating speed |
| | ASR Output | ASR Out | % | ASR output to rated torque |
| | Torque bias | Torque Bias | % | Torque bias to rated torque |
| | Positive Trq Limit | Pos Trq Limit | % | Positive torque limit to rated torque |
| | Negative Trq Limit | Neg Trq Limit | % | Negative torque limit to rated torque |

<table>
<tr><th>Code</th><th>Parameter name</th><th>LCD display</th><th>Unit</th><th>Description</th></tr>
<tr><td rowspan="30">DIS_01<br>~<br>DIS_03</td><td>Regeneration Trq Limit</td><td>Reg Trq Limit</td><td>%</td><td>Regeneration torque limit to rated torque</td></tr>
<tr><td>Torque Reference</td><td>Torque Ref</td><td>%</td><td>Torque reference to rated torque</td></tr>
<tr><td>Torque current ref.</td><td>IqeRef</td><td>%</td><td>Torque current reference to rated torque current</td></tr>
<tr><td>Torque current</td><td>Iqe</td><td>%</td><td>Actual torque current to rated torque current</td></tr>
<tr><td>Flux reference</td><td>Flux Ref</td><td>%</td><td>Flux reference to the rated flux</td></tr>
<tr><td>Flux Current ref.</td><td>IdeRef</td><td>%</td><td>Flux current reference to rated flux current</td></tr>
<tr><td>Flux Current</td><td>Ide</td><td>%</td><td>Actual flux current to rated flux current</td></tr>
<tr><td>ACR output of axis Q</td><td>ACR_Q Out</td><td>V</td><td>ACR output value of axis Q</td></tr>
<tr><td>ACR output of axis D</td><td>ACR_D Out</td><td>V</td><td>ACR output value of axis D</td></tr>
<tr><td>Voltage reference of axis D</td><td>VdeRef</td><td>V</td><td>Voltage reference value of axis D</td></tr>
<tr><td>Voltage reference of axis Q</td><td>VqeRef</td><td>V</td><td>Voltage reference value of Q axis Q</td></tr>
<tr><td>Output current</td><td>Out Amps RMS</td><td>A</td><td>Inverter output current (rms)</td></tr>
<tr><td>Output voltage</td><td>Out Volt RMS</td><td>V</td><td>Inverter output voltage (rms)</td></tr>
<tr><td>Output power</td><td>Power</td><td>kW</td><td>Motor output power</td></tr>
<tr><td>DC LINK voltage</td><td>DC Bus Volt</td><td>V</td><td>Inverter DC link voltage</td></tr>
<tr><td>Process PI reference</td><td>Proc PI Ref</td><td>%</td><td>Reference value of Process PID routine</td></tr>
<tr><td>Process PI Feedback</td><td>Proc PI F/B</td><td>%</td><td>Feedback value of Process PID routine</td></tr>
<tr><td>Process PI output</td><td>Proc PI Out</td><td>%</td><td>Output value of Process PID routine</td></tr>
<tr><td>Motor temperature NTC</td><td>Mot Temp NTC</td><td>deg</td><td>Temp displayed when mot temp sensor is NTC. 25℃ displayed when temp sensor is not provided with the motor.</td></tr>
<tr><td>Motor temperature PTC</td><td>Mot Temp PTC</td><td>deg</td><td>Temp displayed when mot temp sensor is PTC. 25℃ displayed when temp sensor is not provided with the motor.</td></tr>
<tr><td>Inverter temperature</td><td>Inv Temp</td><td>deg</td><td>Inverter Heatsink temp displayed</td></tr>
<tr><td>Inverter i2t</td><td>Inv $i^2t$</td><td>%</td><td>Inverter overload capability displayed. In the case Overload capability is 150% for 1 min, $i^2t$ becomes 100% when 150% of rated current is flowing for 1 min.</td></tr>
<tr><td>MOP output</td><td>MP Output</td><td>%</td><td>Set value displayed when operation is done by potentiometer on terminal input.</td></tr>
<tr><td>Control mode</td><td>Ctrl Mode</td><td></td><td>Selected control mode displayed</td></tr>
<tr><td>Software version</td><td>S/W Version</td><td></td><td>S/W version displayed</td></tr>
<tr><td>Running time</td><td>Run Time</td><td></td><td>Inverter running time displayed after Power On</td></tr>
<tr><td>Input terminal status</td><td>Terminal In</td><td></td><td>ON/OFF status of Input terminal displayed<br>(0: OFF, 1: ON)<br><table><tr><th></th><th>FX</th><th>RX</th><th>BX</th><th>P1</th><th>P2</th><th>P3</th><th>P4</th><th>P5</th><th>P6</th><th>P7</th></tr><tr><td>0 : OFF<br>1 : ON</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr></table></td></tr>
<tr><td>Output terminal status</td><td>Terminal Out</td><td></td><td>ON/OFF status of open collector output, fault relay and contact output.<br>(0: OFF, 1: ON)<br><table><tr><th></th><th>AX1</th><th>AX2</th><th>OC1</th><th>NC</th><th>NC</th><th>30A (30B)</th></tr><tr><td>0 : OFF<br>1 : ON</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0</td><td>0</td><td>0/1</td></tr></table></td></tr>
<tr><td>Running status</td><td>Run Status</td><td></td><td>Operating status displayed</td></tr>
</table>

*1) In the case of using EXTN_I/O, it will be displayed up to Ai5.

### 6.1.3 DIS_04 (Process PID controller)

Information on Output, reference, F/B values of Process PID controller is displayed in this code.




### 6.1.4 DIS_05 (Fault display)

Current fault status, previous two faults, the number of faults occurred and faults information reset are available using [SHIFT/ESC] key in DIS_05.

| Code | LCD display | Parameter name | Description |
|---|---|---|---|
| DIS_05 | Faults | Current Trip displayed | "-------" displayed when normal.<br>Trip information given when tripped. |
| | Last Fault1 | 2nd fault displayed | **Refer to Chapter 8. Troubleshooting.** |
| | Last Fault2 | 1st fault displayed | |
| | Fault Count | Total number of faults | The number of total faults in memory from the initialization until now is displayed. |
| | Fault Clear | Reset | Clear the faults and initialize to "0". |

Faults information, speed reference before fault occurs, speed F/B value, output frequency/ current/ Voltage, torque current reference & actual value, DC Link voltage, input terminal status, output terminal status, Run status, running time can be monitored using [PROG], [▲(Up)] / [▼(Down)] keys. Pressing [ENT] key will return to top. To enter the fault info into memory as [Last Fault 1], press [RESET] key. Refer to [Chapter 9 troubleshooting and maintenance] for more details.

| No | Trip information | LCD display | No | Trip information | LCD display |
|---|---|---|---|---|---|
| 1 | Overcurrent in Phase U | OC-U | 14 | Electronic thermal | E-Thermal |
| 2 | Overcurrent in Phase V | OC-V | 15 | Overload trip | Over Load |
| 3 | Overcurrent in Phase W | OC-W | 16 | External trip B | Ext-B Trip |
| 4 | Fuse Open | Fuse Open | 17 | Communication Error | COM Error |
| 5 | Overvoltage | Over Voltage | 18 | Inverter overload | Inv OLT |
| 6 | IGBT short in phase U | Arm Short-U | 19 | Motor overheat | MotOver Heat |
| 7 | IGBT short in phase V | Arm Short-V | 20 | Inverter thermal open | InvThem OP |
| 8 | IGBT short in phase W | Arm Short-W | 21 | Motor thermal error | MotThem Err |
| 9 | IGBTshot in pahse DB *1) | Arm Short-DB | 22 | Motor over speed | Over Speed |
| 10 | Encorder Error | Encoder Err | 23 | H/W Error | HW-Diag |
| 11 | Low voltage | Low Voltage | 24 | Inverter over heat *2) | OHD Open |
| 12 | Ground fault | Ground Fault | 25 | FAN faulty *2) | FAN LOCK |

※ **Note :**

**When multiple faults occur at the same time, the MOST CRITICAL fault will be displayed and the rest of others can be inferred from the value using [PROG], [▲(Up)] / [▼(Down)] keys .**

*1) Applicable only to SV110~220V5.

*2) Applicable only to SV2800~3750V5.

### 6.1.5 DIS_06(User group display selection)

User can make "User group" by collecting frequently used codes. In DIS_06, user can set whether User group is displayed or not in three selections.

| Code | LCD display | Parameter name | Description | |
|---|---|---|---|---|
| DIS_06 | Usr Grp Disp | User group display selection | Not Used | User group not displayed |
| | | | Dis+Usr Grp | Only Display + User group displayed. The rest of groups are not displayed. If you want to display the rest, move to other group in Jump code or change the selection. |
| | | | Display ALL | Display all groups including User group. But, 2nd group is displayed only when 2nd group is defined. EXT group is displayed when Option board is installed. |

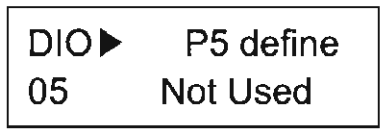
## 6.2 DIO Group (DIO_[][])

### 6.2.1 Jump code (DIO_00)

In I/O_00, jumping directly to any parameter code can be accomplished by entering the desired code number.

**(Example) Moving to I/O_05**

Press [PROG] and set to 5 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key to move to I/O_05. If the desired code cannot be set, the closest code will be displayed.




Jumping other code is available using [▲(Up)] / [▼(Down)] keys.

### 6.2.2 Multi-function input terminal

**1) DIO_01 ~ DIO_07 (Multi-function input terminal P1 ~ P7 define)**

It defines Multi-function input terminals. SV-iV5 has 7 dedicated terminals (P1 ~ P7) for the setting of parameters below. However, the multiple terminals cannot be selected for the same function and if so, the invalid terminal definition is displayed as "Not Used". And the selected function cannot be adjusted while running.

| No | Set value | Description | No | Set value | Description |
|---|---|---|---|---|---|
| 1 | Speed-L | Multi-step speed-Low | 15 | Ext Trip-B | External trip B contact |
| 2 | Speed-M | Multi-step speed-Middle | 16 | Prohibit FWD | Forward Run Disabled |
| 3 | Speed-H | Multi-step speed-High | 17 | Prohibit REV | Reverse Run Disabled |
| 4 | Jog Speed | Jog speed | 18 | Proc PID Dis | PID operation disabled |
| 5 | MOP Up | MOP UP operation | 19 | Timer Input | Timer ON |
| 6 | MOP Down | MOP Down operation | 20 | SoftStrtCncl | Cancel Soft start |
| 7 | MOP Clear | MOP Speed Clear (Reset) | 21 | ASR Gain Sel | Switch ASR gain |
| 8 | MOP Save | MOP Speed Save | 22 | ASR P/PI Sel | Switch ASR P/PI |
| 9 | Analog Hold | Analog speed ref. Hold | 23 | Flux Ref Sel | Switch Flux reference |
| 10 | Main Drive | Exchange between Option and Inverter | 24 | PreExcite | Pre-excitation |
| 11 | 2nd Func | The 2nd function | 25 | Spd/Trq Sel | Speed/Torque control select |
| 12 | Xcel-L | Multi-accel/decel-Low | 26 | Use Max Trq | Torque limit ON/OFF |
| 13 | Xcel-H | Multi-accel/decel-High | 27 | Use Trq Bias | Torque bias ON/OFF |
| 14 | 3-Wire | 3 Wire | 28 | Battery Run | Selection of battery-operated |

**1.1) Speed-L**

**1.2) Speed-M**

**1.3) Speed-H**

**1.4) JOG operation**

By defining P1 ~ P4 as "Speed-L", "Speed-M", "Speed-H" and "Jog Speed", the selected references in FUN goup 12 ~ 20 (Multi-step speed 0 ~ 7 and Jog speed) become active as speed reference.

**(Example)** To define Multi-function input terminals P1, P2, P3 as Speed-L, Speed-M, Speed-H and P4 as Jog Speed;

| Code | LCD display | Description | Setting range | Unit | Set value |
|---|---|---|---|---|---|
| DIO_01 | P1 define | Multi-function input terminal P1 define | | | Speed-L |
| DIO_02 | P2 define | Multi-function input terminal P1 define | | | Speed-M |
| DIO_03 | P3 define | Multi-function input terminal P3 define | | | Speed-H |
| DIO _04 | P4 define | Multi-function input terminal P4 define | | | Jog Speed |

When multi-step speed 0 (FUN_12: Speed 0) is selected (P1, P2, P3 = OFF), speed reference is input by the method set in FUN_02 (Analog, keypad 1/2, option). If the jog (FUN_20) is active, inverter operates with jog frequency regardless of other terminal signal input.

| P1 | P2 | P3 | P4 | Set Vaule |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | FUN_02: keypad→ FUN_12(Speed 0) |
| **ON** | OFF | OFF | OFF | FUN_13(Speed 1) |
| OFF | **ON** | OFF | OFF | FUN_14(Speed 2) |
| **ON** | **ON** | OFF | OFF | FUN_15(Speed 3) |
| OFF | OFF | **ON** | OFF | FUN_16(Speed 4) |
| **ON** | OFF | **ON** | OFF | FUN_17(Speed 5) |
| OFF | **ON** | **ON** | OFF | FUN_18(Speed 6) |
| **ON** | **ON** | **ON** | OFF | FUN_19(Speed 7) |
| X | X | X | **ON** | FUN_20(Jog Speed) |

**1.5) MOP (Motor operated potentiometer) Up**

**1.6) MOP Down**

**1.7) MOP Clear**

**1.8) MOP Save**

When multi-function input terminals P1 ~ P7 is set to "MOP Up", "MOP Down", inverter performs Accel/Decel Constant Run according to the terminal input. Generally, MOP function is used to adjust the speed simply with terminal ON/OFF. When MOP UP/Down is selected, inverter ignores FUN_02 setting, and performs MOP operation. To cancel it, change the defined terminal to "Not Used". If this function is selected with "Main Drive" function, operating reference is done by MOP and the rest will be defined by "Main Drive" function. Max speed limit is FUN_04(Max Speed).

If "MOP Save" is entered during MOP operation, the current speed reference value is saved as "MOP Data" and

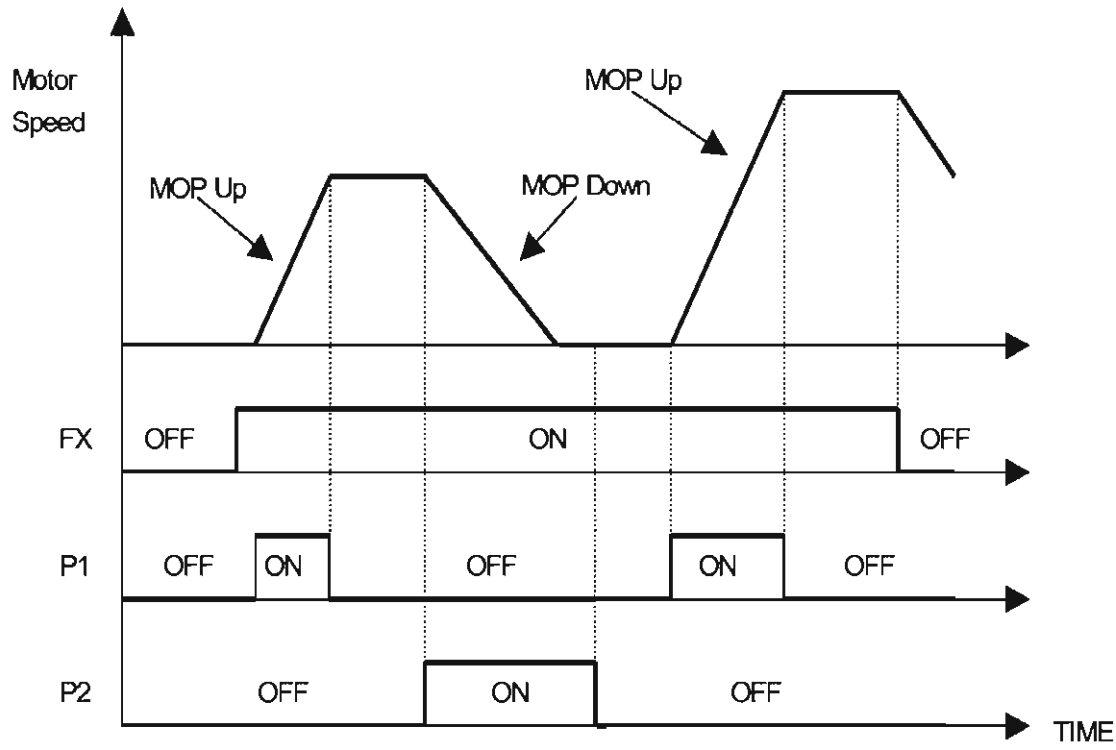
retained. When the MOP operation resumes, the retained value will be used as speed reference.

"MOP Clear" resets the MOP Data value to "0". It is used to change the saved value.

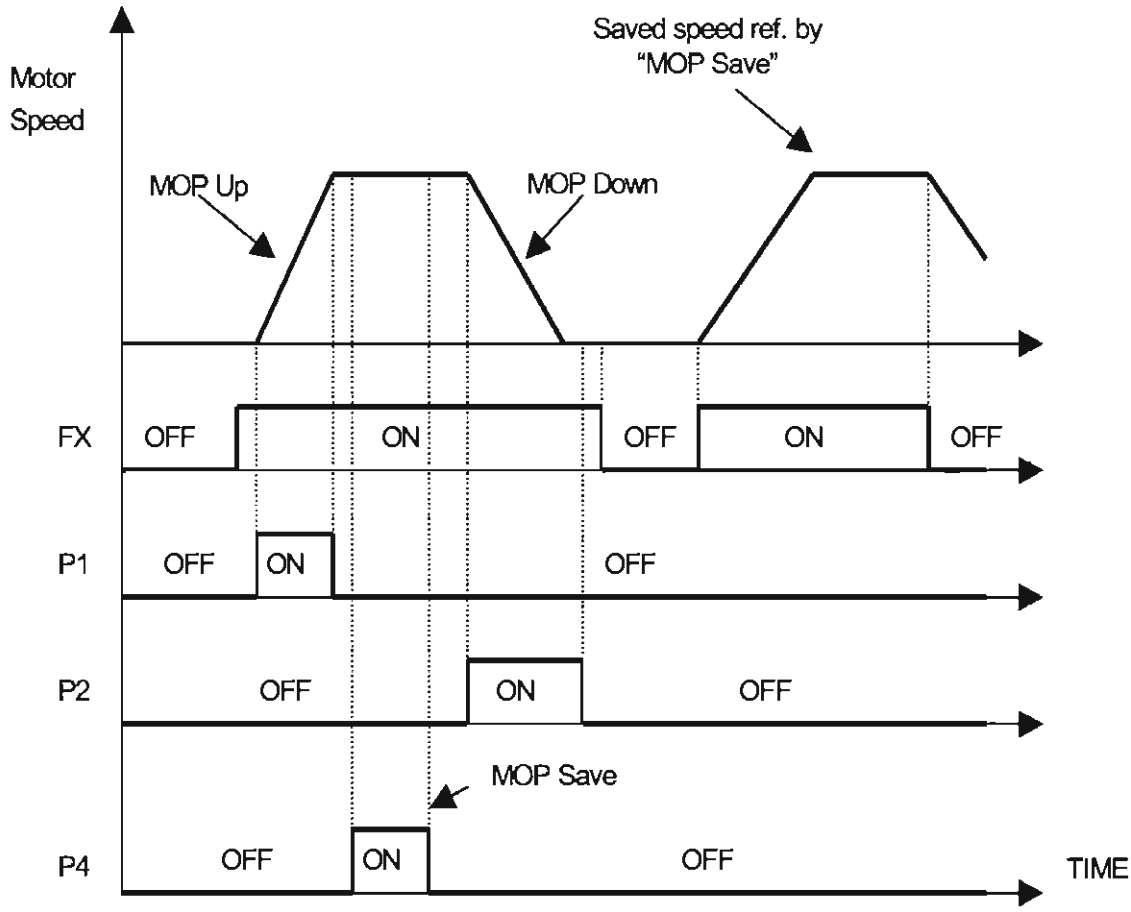
**(Example)** MOP function setting and operation method is as follows;

| Code | LCD display | Description | Setting range | Unit | Set value |
|---|---|---|---|---|---|
| DIO_01 | P1 define | Multi-function input terminal P1 define | | | MOP Up |
| DIO_02 | P2 define | Multi-function input terminal P1 define | | | MOP Down |
| DIO_03 | P3 define | Multi-function input terminal P3 define | | | MOP Clear |
| DIO_04 | P4 define | Multi-function input terminal P4 define | | | MOP Save |

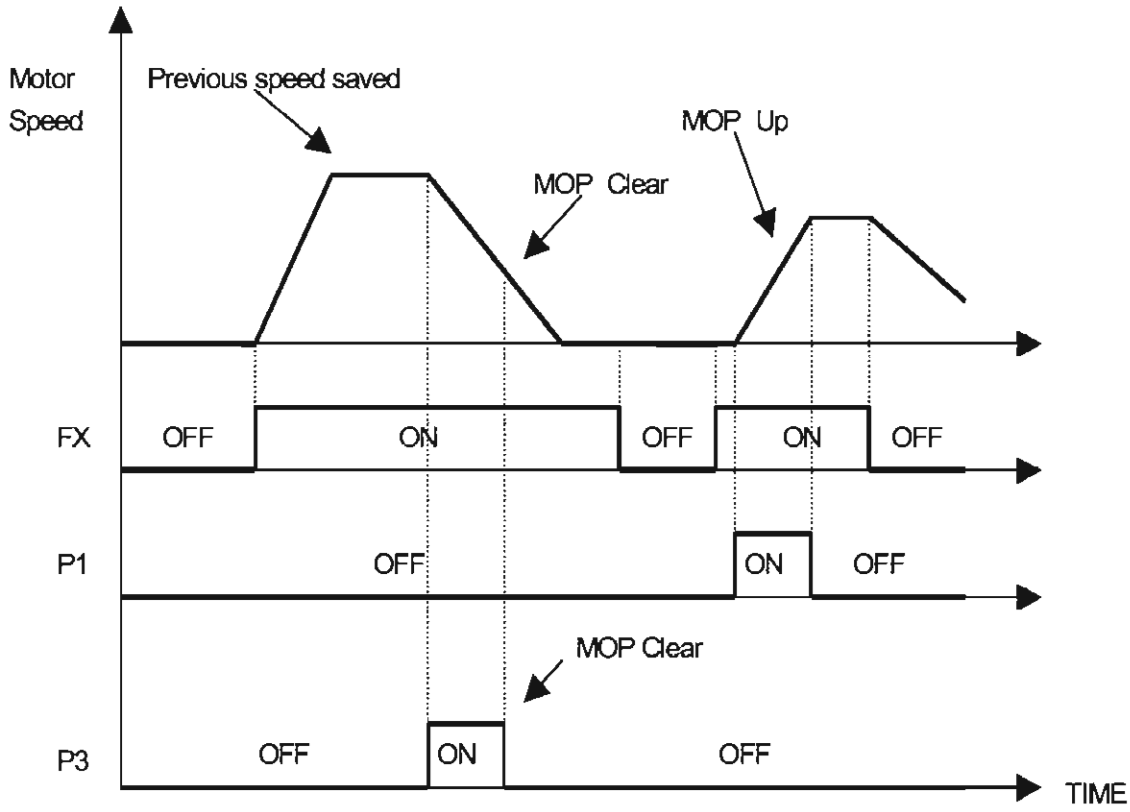
(MOP Up/Down example 1) This is used only if terminal ON/OFF is required for speed control.



(MOP Save example 2) In case terminal input assigned to MOP Save function is ON, operation speed at that instant is memorized and operates at the saved speed when operation resumes.

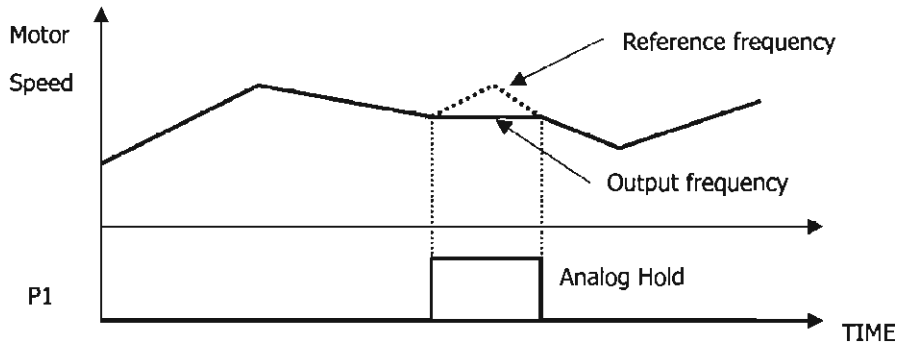


(MOP Clear setting example 3) To clear the saved speed by MOP Save function, use "MOP Clear ON/OFF". If MOP Clear is ON during running, the inverter decelerates its speed to zero speed. If MOP is ON during stop, this function resets the speed reference to "0".



### 1.9) Analog Hold

When FUN_02 is set to "analog" and one of the selected terminal set to "Analog Hold" is ON, inverter fixes its output frequency, regardless of the frequency reference change. The changed frequency reference is applied when the terminal is OFF. This function is useful when a system requires constant speed after acceleration.




### 1.10) Main Drive

Each inverter linked to system can be controlled separately. When this terminal is turned On, changing operating speed reference, operating method, and torque limit is done via only Keypad without changing the user-setting parameter value.

When 'Main Drive' terminal is turned On, Main Drive operation is available as shown below condition.

- Inverter during stop: It is applied immediately.
- Inverter during operation: It is applied after stop.

The parameter value of FUN_01 Run/Stop Src, FUN_02 Spd Ref Sel, CON_28 Trq Lmt Src related with Operating speed reference, Operating method, and Torque limit is not applied when 'Main Drive' terminal is turned On even though parameter is changed via keypad or communication. It is applied when the terminal is turned Off during stop.

The parameter value of CON_01 Control Mode is operated same as above parameter described.

The setting of Operating speed reference, Operating method and Torque limit is set as shown below.

| Function | "Main Drive" ON | "Main Drive" OFF | Applied point of time |
|---|---|---|---|
| Operating method | Keypad mode | Parameter value of FUN_01 Run/Stop Src | After inverter stop |
| Operating Speed reference | Keypad1 mode | Parameter value of FUN_02 Spd Ref Sel | |
| Torque Limit | Kpd Kpd Kpd mode | Parameter value of CON_28 Trq Lmt Src | |
| Control Mode | Speed mode | Parameter value of CON_01 Control Mode | |

### 1.11) 2nd Func (the 2nd function setting)

The iV5 inverter has the capability to control 2 motors independently. A second motor may be active by selecting one terminal for this function and turn it ON. 2nd function is not displayed if the terminal is not defined for this or the defined terminal is OFF.

※ Cross reference table for **1st function and& 2nd function**

| Parameter | 2nd function | | 1st function | |
|---|---|---|---|---|
| Acceleration time | 2nd_09 | 2nd Acc time | FUN_40 | Acc. Time 1 |
| Deceleration time | 2nd_10 | 2nd Dec time | FUN_41 | Dec. time 1 |
| Encoder-related parameter | 2nd_12 ~ 2nd_14 | | PAR_11 ~ PAR_15 | |
| Motor constants | 2nd_15 ~ 2nd_26 | | PAR_16 ~ PAR 30 | |
| Electronic thermal level for 1 min | 2nd_32 | 2nd ETH 1min | FUN_55 | ETH 1min |
| Electronic thermal level for continous | 2nd_33 | 2nd ETH Cont | FUN_56 | ETH Cont |

**※ Note : 1st & 2nd function switch-over should be selected when the motor is stopped.**
**If selected during RUN, 2nd function is not active until motor stop.**

6

### 1.12) XCEL-L

### 1.13) XCEL-H

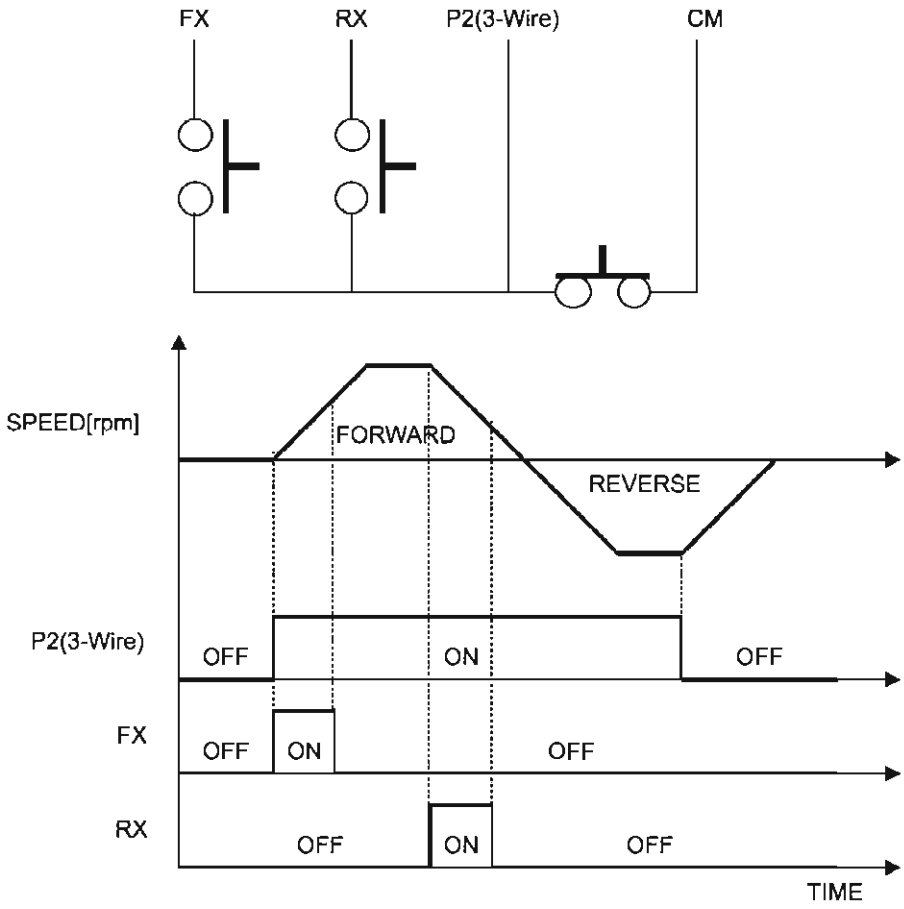
Refer to FUN_40 ~ 47 (Accel/ Decel time 1, 2, 3, 4).

| Code | LCD display | Description | Factory setting |
|---|---|---|---|
| FUN_40 | Acc Time-1 | Accel time 1 | 2.00(sec) |
| FUN_41 | Dec Time-1 | Decel time 1 | 2.00(sec) |
| FUN_42 | Acc Time-2 | Accel time 2 | 3.00(sec) |
| FUN_43 | Dec Time-2 | Decel time 2 | 3.00(sec) |
| FUN_44 | Acc Time-3 | Accel time 3 | 4.00(sec) |
| FUN_45 | Dec Time-3 | Decel time 3 | 4.00(sec) |
| FUN_46 | Acc Time-4 | Accel time 4 | 5.00(sec) |
| FUN_47 | Dec Time-4 | Decel time 4 | 5.00(sec) |

### 1.14) 3-Wire operation

When FX or RX terminal is turned ON and turned OFF, the terminal is maintained ON using this parameter.

**(Operating method when P2 is set to 3-Wire)**




[3 Wire operation]

### 1.15) Ext Trip-B (External trip signal input by b contact)

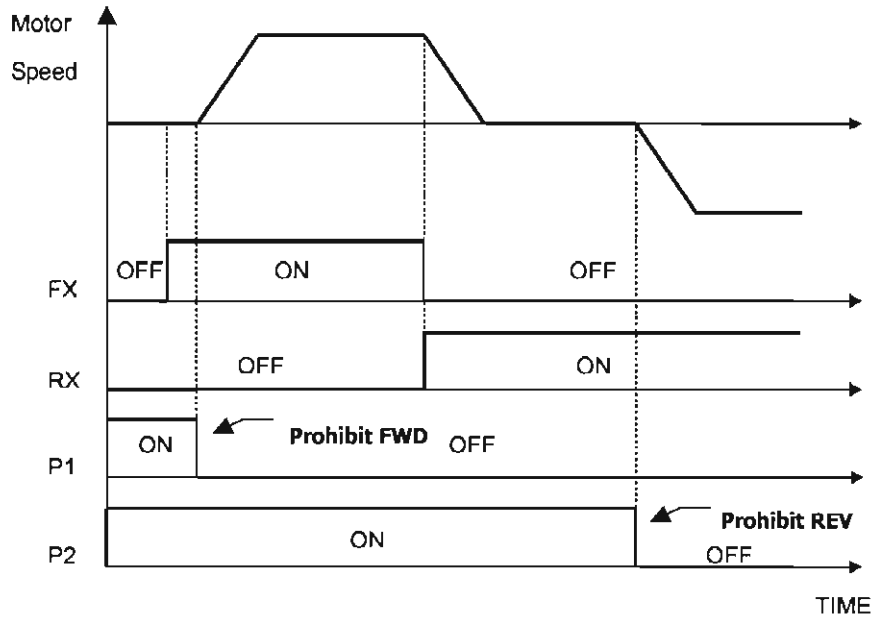
If the terminal set to this function is off, the inverter disables the gating of IGBT and then the motor freely rotates to a stop. The message written as "External Trip Signal B contact" appears on the LCD screen and STOP LED is blinking in the keypad. This signal can be used as an external latch trip.

### 1.16) Prohibit FWD (Prohibition of forward rotation)

### 1.17) Prohibit REV (Prohibition of reverse rotation)

If Prohibit FWD or Prohibit REV is set, it prohibits forward or reverse rotation, respectively. If Prohibit FWD is used, speed command becomes 0 when it has positive value. Similarly, If Prohibit REV is used, speed command becomes 0 when it has negative value.

**(Example)** When multi-function input terminal P1 is set to "prohibit FWD" and P2 to "prohibit REV" the following diagram will be shown.




### 1.18) Proc PID Dis (Process PID disabled)

This function is used to disable the Process PID controller. If Proc PID Enb at the CON_20 is ON and also this terminal is ON, the output of Process PID controller becomes zero. Otherwise, Process PID controller generates its output depending on the controller operation. 'Proc PID Enb' at CON_20 determines whether this function is used or not. The setting for this code is as follows.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_20 | Proc PID Enb | Proc PID contoller Enable/Disable | Disable<br>Enable<br>Terminal | | Disable |

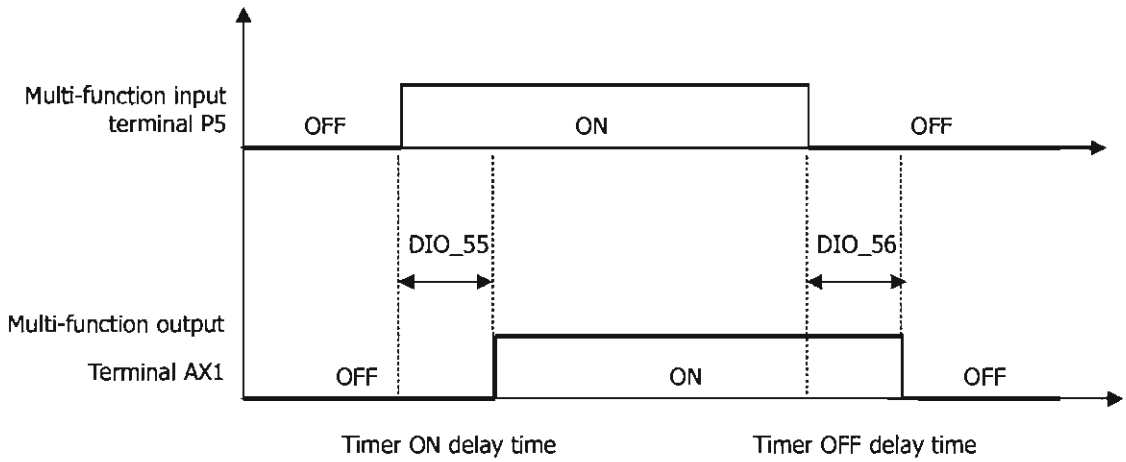
'Disable' at CON_20 blocks the output of Process PID controller and 'Enable' at CON_20 enables the Process PID controller. If 'Terminal' is set, the multi-function terminal set to 'Proc PID Dis' determines whether the output of Process PID controller is enabled or not. To prevent the saturation of Process PID controller, Process PID controller is enabled only if the multi-function input terminal is set to 'Proc PID Dis' and its terminal input is OFF and operation command is 'ON'. Process PID controller does not work if operation command is not ON or 'Process PID Disable' is not set. Truth table is as follows.

| CON_20 | Proc PID Dis | Operating reference | |
|---|---|---|---|
| | Multi-function input signal | ON | OFF |
| Terminal | ON | Disable | Disable |
| | OFF | Enable | Disable |
| Enable | | Enable | Disable |
| Disable | | Disable | Disable |

### 1.19) Timer input

The multi-function input terminals P1~P7 can generate the timer output based on the timer ON delay time at I/O_55 and timer Off delay time at I/O_56. The following example is the case where I/O_05 is set to timer input and the multi-function output terminal AX1 at I/O_41 is set to 'Timer Out'.

| Code | LCD display | Description | Setting range | Unit | Setting value |
|---|---|---|---|---|---|
| DIO_05 | P5 Define | Multi-function input terminal P5 Define | | | Timer Input |
| DIO_41 | AX1 Define | Multi-function output terminal AX1 Define | | | Timer Out |
| DIO_55 | TimerOn Dly | Timer On Delay Time | 0.1 ~ 3600.0 | sec | |
| DIO_56 | TimerOff Dly | Timer Off Delay Time | 0.1 ~ 3600.0 | sec | |




### 1.20) SoftStartCncl (Soft Start Cancel)

Soft start cancel is used when the shortest acceleration/deceleration time is required without using the existing accel/decel time. In this case, real acceleration/deceleration time depends on the load condition and response characteristic of speed controller. The following table shows what kind of acceleration/deceleration time is used when P1, P2 and P3 are used for the transfer of accel/decel time or soft start cancel function is enabled.

**(Example) Programming P3 as SoftStrtCncl**

| P1 (Xcel-L) | P2 (Xcel-H) | P3 (SoftStartCncl) | Accel/Decel time |
|---|---|---|---|
| OFF | OFF | OFF | Accel/Decel 1 |
| ON | OFF | OFF | Accel/Decel 2 |
| OFF | ON | OFF | Accel/Decel 3 |
| ON | ON | OFF | Accel/Decel 4 |
| X | X | ON | The shortest Accel./Decel. |

### 1.21) ASR Gain Sel (Switch automatic seed regulator PI gain)

Using 'ASR Gain Sel' function, one of the two P and I gains can be selected for PI speed controller (ASR).

**(Example) Programming P5 as ASR PI Gain**

| Code | LCD display | Description | Setting range | Unit | Setting value |
|---|---|---|---|---|---|
| DIO_05 | P5 define | Multi-function input terminal P5 Define | | | ASR Gain Sel |
| CON_03 | ASR P Gain1 | ASR (Automatic Speed Regulator) P Gain 1 | 0.0 ~ 200.0 | % | P5 : OFF |
| CON_04 | ASR I Gain1 | ASR I Gain 1 | 0 ~ 50000 | ms | |
| CON_05 | ASR LPF1 | ASR LPF time constant 1 | 0 ~ 20000 | ms | |
| CON_06 | ASR P Gain2 | ASR P Gain 2 | 0.0 ~ 200.0 | % | P5 : ON |
| CON_07 | ASR I Gain2 | ASR I Gain 2 | 0 ~ 50000 | ms | |
| CON_08 | ASR LPF2 | ASR LPF time constant 2 | 0 ~ 20000 | ms | |

### 1.22) ASR P/PI Sel (ASR P/PI Transfer)

The ASR could be P controller or PI controller by MFI programmed as ASR P/PI Sel. When the ASR Gain is switched to each other, the effective P gain could be changed gradually with the time ASR Ramp CON_09 in order to prevent the shock in the machine because of the quick change of P gain.

**(Programming Example) Programming P6 as ASR P/PI Sel.**

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| DIO_05 | P5 define | Multi-function input terminal P5 Define | | | ASR P/PI Sel |

### 1.23) Flux Ref Sel (Flux reference selection)

If the flux reference selection is ON, flux reference is set to the value which analog voltage (-10 ~ 10V) is converted to % ratio of the rated flux.

### 1.24) PreExcite (Pre-excitation)

This function enables the motor to build up the flux by flowing the magnetizing current into It before run command is ON so that speed control characteristic can be improved at the time of the acceleration of the motor.

**1.25) Spd/Trq Sel (Speed/Torque Control Transfer)**

Speed and torque control can be switched using this function. This terminal input overrides the input from the keypad. Control mode can be switched only during stop state. Despite multi-function terminal input during running, the control mode can be switched only after stopping.

**1.26) Use Max Torque (Maximum Torque Enable)**

If this input is ON, the torque limit value of the speed controller is fixed to its maximum value. On the contrary, when this input turns off, the value defined at CON_29 ~ CON_31 applies to torque limit value. This function disables the inverter continous operation.

If this function is used continously, it may lead to damage to the motor and inverter. Take caution when using this function.

**1.27) Use Trq Bias (Torque Bias enable)**

If one of the multi-function terminals (P1 ~ P7) is selected as "Use Trq Bias", torque bias value is fed into the inverter following the input signal. Besides, if "Use Trq Bias" is not set, and 'Keypad' is set at CON_32, torque bias value set at CON_33 is fed into the inverter. And, if "Analog" is set at CON_32 (Trq Bias Src), and the input is selected as "Torque Bias", the torque bias value is fed into the inverter. Therefore, in order not to use the torque bias value, 'None' should be set at CON_32 or one of the multi-function terminals (P1 ~ P7) should be selected as "Use Trq Bias" and then be kept the terminal Open.

**1.28) Battery Run (Selection of battery-operated mode)**

When main power is not able to use by simultaneous power failure at elevator application, motor can be operated temporarily with battery power.

This function is available from 5.5 to 22kW/-2/4 products. Refer to '6.4.14 Battery Run speed and input voltage setting' for details of Battery Run.

**2) DIO_08 (Reversal of Multi-function input terminal)**

Multi-function input terminal is based on the 'A' contact operation. If a specific terminal should be changed to 'B' contact operation, the relevant terminal setting should be set from '0' to '1', Once the relevant terminal is set to '1', the terminal operates on the basis of 'B' contact and it is effective before it is changed to '0'. But, in case of the external trip 'B' contact, it is changed to 'A' contact operation. Terminals are displayed in the order of P1, P2, P3, P4, P5, P6 and P7 from the beginning.

(P1 ~ P7: A contact)

| DIO ▶ Neg Function | |
|---|---|
| 08 | 0000000 |

(P1, P6: B contact)

| DIO ▶ Neg Function | |
|---|---|
| 08 | 1000010 |

**3) DIO_09 (Low pass filter time constant for the terminals)**

This setting affects the response speed of the control circuit terminals (FX, RX, BX, P1 ~ P7, RST). It is greatly effective when electro-magnetic noise signal is present in the input signal. The larger the time constant becomes, the slower response speed becomes. Response speed is approximately proportional to the setting value times 2.5 [m sec].

### 6.2.3 Multi-function digital output terminal

**1) DIO_10 Inversion of Multi-function aux contact output (Relay output, Open collector output)**

Factory default settinf of Multi-function Relay outputs is A contact. To change it to B contact, set it to "1".

See the below for setting example: (terminal layout is AX1, AX2, OC1, NC, NC from left.)

(Setting example)

(AX1 ~ OC1: A contact)

| DIO ▶ Neg Func.Out |
|---|
| 10 00000 |

(AX1, OC1: B contact)

| DIO ▶ Neg Func.Out |
|---|
| 10 10100 |

**2) DIO_41 ~ 43 (Multi-function aux contact output (AX1 ~ AX2) and Open collector (OC1) output setting)**

Multi-function digital output terminal serves as one of the functions listed in the table below. Multi-function aux contact Is activated when the selected function Is ON.

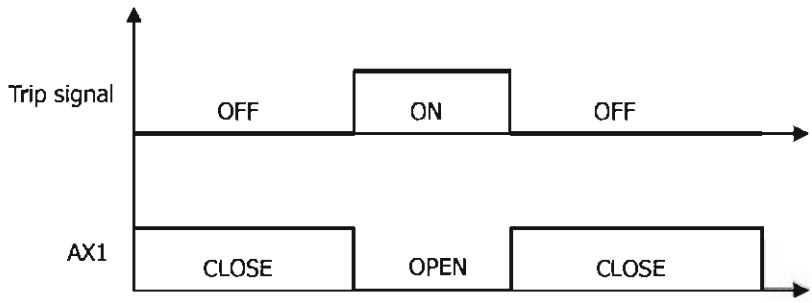
| No | Set value | No | Set value |
|---|---|---|---|
| 1 | Not Used | 11 | Mot OH Warn |
| 2 | INV Ready | 12 | INV OH Warn |
| 3 | Zero Spd Det | 13 | Speed Agree |
| 4 | Spd Det. | 14 | Trq Det. |
| 5 | Spd Det (ABS) | 15 | Trq Lmt Det. |
| 6 | Spd Arrival | 16 | OverLoad |
| 7 | Timer Out | 17 | Stop |
| 8 | LV Warn | 18 | Steady |
| 9 | Run | 19 | Brake Output |
| 10 | Regenerating | | |

**2.1) Not used**

It is set unless multi-function output is not used as any function listed above.

**2.2) INV ready**

INV Ready becomes ON when inverter is ready to operate normally. If trip signal occurs, INV Ready is left OPEN immediately as shown in the figure below.

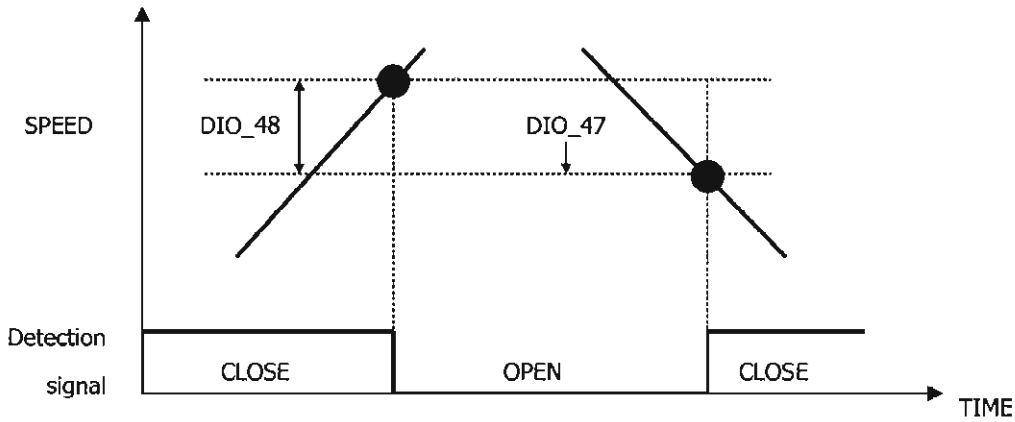


### 2.3) Zero Spd Det

Detects zero speed of motor. See the figure below.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_47 | ZSD Level | Zero Speed Detect Level | 0.0 ~ 480.0 | rpm | 10 |
| DIO_48 | ZSD Band | ZSD hysteresis band | 0.1 ~ 10.0 | % | 0.5 |

- DIO_48(ZSD Band) is set as the percentage of FUN_04 Max motor speed.



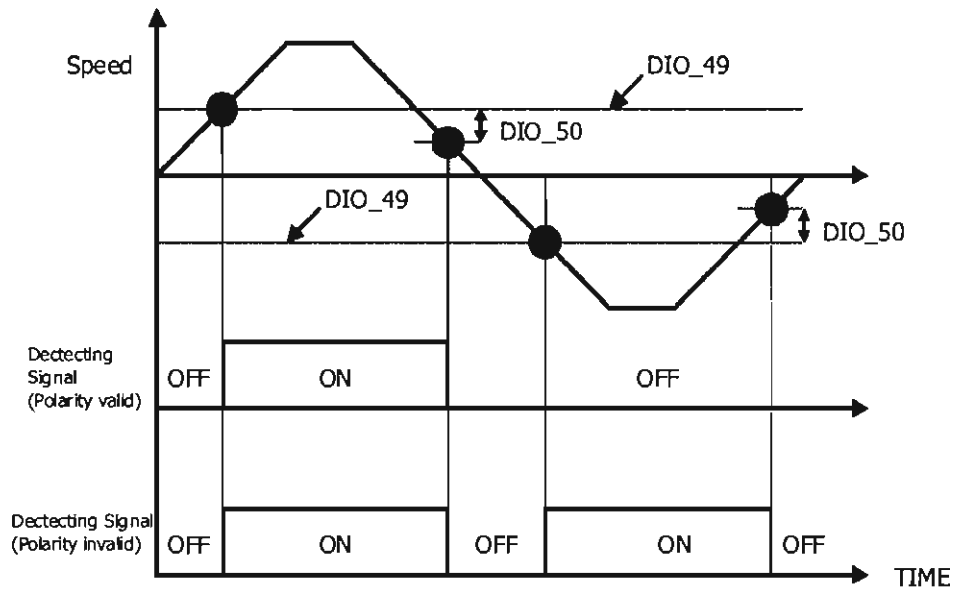

### 2.4) Spd Det. – Polarity valid

### 2.5) Spd Det.(ABS) – Polarity invalid

This is ON when the real motor speed reaches the arbitrary speed. The polarity of detecting speed is valid for Spd Det. But, the polarity is invalid for Spd Det(ABS).

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_49 | SD Level | Speed Detect Level | -3600 ~ 3600 | rpm | 0 |
| DIO_50 | SD Band | Speed Hysterisis Band | 0.1 ~ 10.0 | % | 0.5 |

- DIO_49(SD Band) is set as the percentage of FUN_04 Max motor speed.



### 2.6) Spd arrival

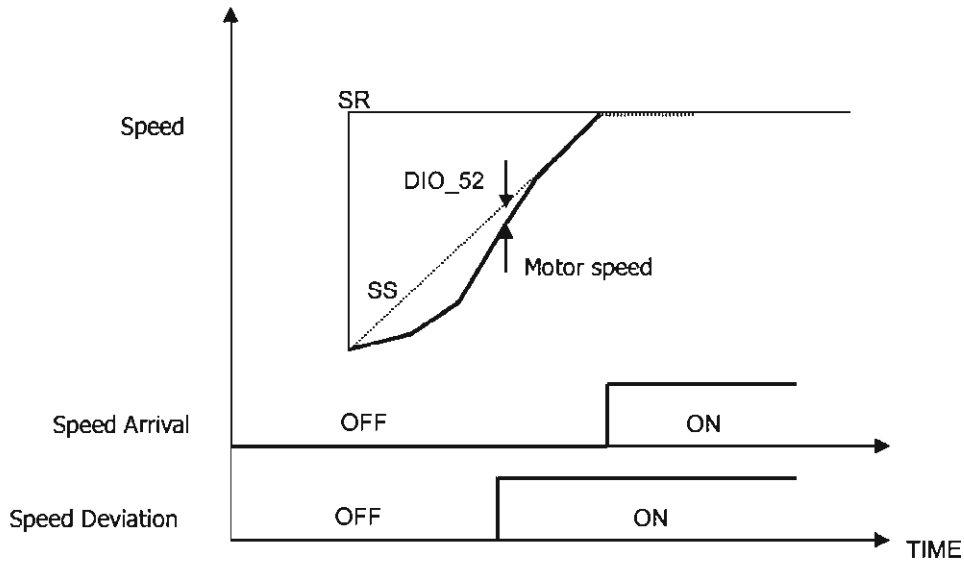
It detects whether the motor reaches the set speed band.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO _51 | SA Band | SA hysterisis band | 0.1~10.0 | % | 0.5 |

### 2.7) Spd agree

This is ON when the motor speed becomes equal to the set speed.

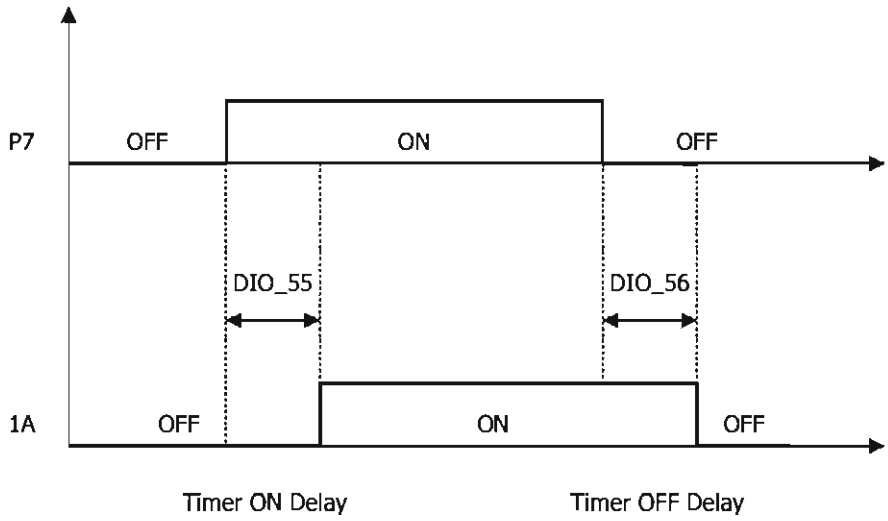
| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_52 | SEQ Band | SEQ hysterisis band | 0.1 ~ 10.0 | % | 0.5 |




### 2.8) Timer out

Timer Out acts as an output signal to the timer input signal defined in the one of the multi-function input terminals P1~P7 and it uses the set values of Timer On delay time at I/O_55 and of Timer Off delay time at I/O_56. The example of code setting is shown in the table below when I/O_07 is set to Timer Input and I/O_41 is set to Timer Output.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_07 | P7 define | Definition of P7 | | | Timer Input |
| DIO_41 | AX1 Define | Definition of multi-function output terminal relay output 1 (1A, 1B) | | | Timer Out |
| DIO_55 | TimerOn Dly | Timer ON delay | 0.1 ~ 3600.0 | sec | 0.1 |
| DIO_56 | TimerOff Dly | Timer OFF delay | 0.1 ~ 3600.0 | sec | 0.1 |




**2.9) LV**

LV is enabled when the DC link voltage of the inverter is less than the detecting level of low voltage alarm.

**2.10) Run**

It is ON when the inverter is running.

**2.11) Regenerating**

It is ON when the motor is regenerating.

**2.12) Mot OH Warn (Motor Overheat Warning)**

Using NTC or PTC signal built in the motor, Motor Overheat is ON when the temperature inside the motor is higher than the overheat alarm level. This signal is only for an alarm, not for the inverter trip.

※In the case of ExTTN_I/O it corresponds to Ai5 Ai3 Define[AIO_25 ] is set to "Use Mot NTC" or "Use Mot PTC".

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_64 | MH Warn Temp | Motor overheat detect | 75 ~ 130 | °C | 120 |
| DIO_65 | MH Warn Band | MH hysterisis band | 0 ~ 10 | °C | 5 |

**2.13) Inv OH Warn (Inverter Overheat Warning)**

Inverter Overheat is ON, when the heatsink inside the inverter is higher than the overheat alarm level. This signal is only for an alarm, not for the inverter trip.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_62 | IH Warn Temp | Inverter Overheat Detection Temperature | 50 ~ 85 | °C | 75 |
| DIO_63 | IH Warn Band | Inverter Overheat Detection Bandwidth | 0 ~ 10 | °C | 5 |

**2.14) Trq Det.**

Trq Det is ON when the torque output of ASR reaches the setting torque level.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_53 | TD level | Torque Detect Level | 0.0 ~ 250.0 | % | 0.0 |
| DIO_54 | TD Band | TD hysterisis band | 0.1 ~ 10.0 | % | 0.5 |

### 2.15) Trq Lmt Det

Trq Lmt Det is ON when the output of ASR (Torque reference) is saturated so that its limit value is generated.

### 2.16) OverLoad

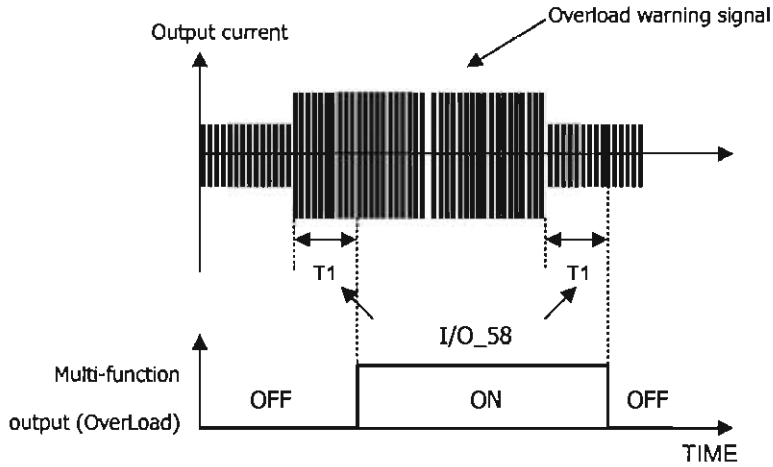
Overload is ON when the inverter output current is higher than the overload alarm level. (On the basis of the rated current of the motor) Refer to the following values of overload alarm level (DIO_57) and overload alarm time (DIO_58).

- **DIO_57: [Overload warning level], DIO_58 [Overload warning time]**

If the inverter output current keeps flowing more than overload alarm level (DIO_57) and longer than overload alarm time (DIO_58), alarm signal is triggered. The overload signal is canceled when the inverter output current flows less than overload alarm level (DIO_57) and longer than overload alarm time (DIO_58) has passed.

Overload alarm signal can be generated by the multi-function outputs (1A-1B, 2A-2B, OC1-EG). "OL" should be set in the DIO_41, 42 and 43 [Multi-function auxiliary terminal output setting] to use this function. Even if overload occurs, its alarm signal is generated through the multi-function output terminal and the inverter keeps running.






| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_57 | OL level | Overload warning level | 30 ~ 250 | % | 150 |
| DIO_58 | OL time | Overload warning time | 0 ~ 30 | sec | 10 |

- Note: The set value of overload alarm level is of percentage(%) to the rated current of the motor.

### 2.17) Stop

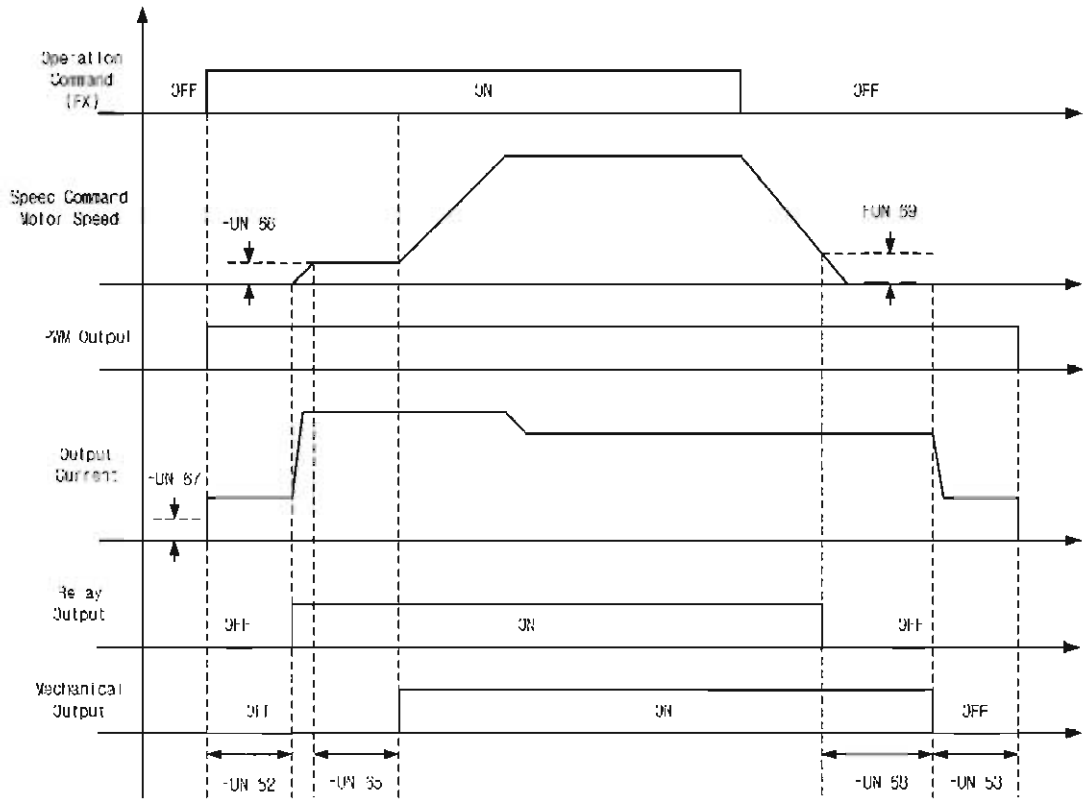
'Stop' is ON when the inverter keeps stopping.

### 2.18) Steady

This is ON when the inverter is running at the constant speed.

### 2.19) Brake output

**Output the signal of opening or closing of brake.**




| Code | Display | Decription | Range | Unit | Default |
|---|---|---|---|---|---|
| FUN_65 | BKOpen Time | Brake opening time | 0.00 ~ 30.00 | sec | 0.00 |
| FUN_66 | BKOpen Spd | Brake opening speed | 0.0 ~ 500.0 | rpm | 0.0 |
| FUN_67 | Release Curr | Brake opening current | 0.0 ~ 150.0 | % | 20.0 |
| FUN_68 | BKClose Time | Brake closing time | 0.00 ~ 30.00 | sec | 0.00 |
| FUN_69 | BKClose Spd | Brake closing speed | 0.0 ~ 500.0 | rpm | 0.0 |

**Note : Brake opening current value is set as a percentage of the motor magnetic current.**

### 3) DIO_46 (Fault output relay (30A, 30B, 30C))

This function can be used when the inverter fault signal is generated through the relay contact. the fault alarm is triggered differently by setting the bits related to the low voltage trip, inverter trip and the number of retry.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_46 | Relay mode | Relay mode | 000 ~ 111 | | 011 |

| Code | Bit 2 (Number of Auto retry) | Bit 1 (Inverter trip) | Bit 0 (LV trip) |
|---|---|---|---|
| DIO_46 | 0/1 | 0/1 | 0/1 |

| Bit | Setting | Description |
|---|---|---|
| Bit 0 (LV) | 0 | Deactivated at Low Voltage Trip |
| | 1 | Activated at Low Voltage Trip |
| Bit 1 (Trip) | 0 | Deactivated at any fault |
| | 1 | Activated at any fault except Low Voltage Trip |
| Bit 2 (Retry) | 0 | Deactivated at the auto retry attempt |
| | 1 | Activated at the number of auto retry attempt |

### 4) DIO_59 ~ 61 (Overload trip enable, level, time)

If the inverter output current higher than the overload limit level is kept for the overload limit time, the inverter blocks the gating of IGBTs and Issues the trip message.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| DIO_59 | OLT select | Overload trip enable | Yes/No | | Yes |
| DIO_60 | OLT level | Overload trip level | 30 ~ 250 | % | 180 |
| DIO_61 | OLT time | Overload trip time | 0 ~ 60 | sec | 60 |

- Note: DIO_60 is set as the percentage of Motor rated current.

### 5) DIO_97(Operation method when losing command)

You can choose the operation method when multi-function analog input signal satisfying the criteria for the signal loss of analog input and the condition of multi-function analog input signal loss judging time. Refer to analog I/O Group for the criteria for the multi-function analog input signal loss and the judging time of signal loss.

| Code | Display | Function Name / Range | Unit | Description |
|---|---|---|---|---|
| DIO_97 | Lost Command | None | | Continuing the operation when losing command |
| | | Free-run | | Free-run stop when losing command |
| | | Stop | | Decelerating stop when losing command |

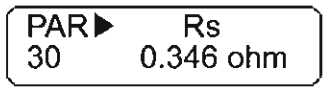
## 6.3 Parameter Group (PAR_[][])

### 6.3.1 Jump code (PAR_00)

PAR_00, jumping directly to any parameter code can be accomplished.

**(Example) Moving to PAR_30**

Press [PROG] and set to 30 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key. If the desired code cannot be set (void), the nearest code will be displayed.




Use [▲(Up)] / [▼(Down)] to move to other codes.

### 6.3.2 Parameter group function

**1) PAR_01 (Parameter initialize)**

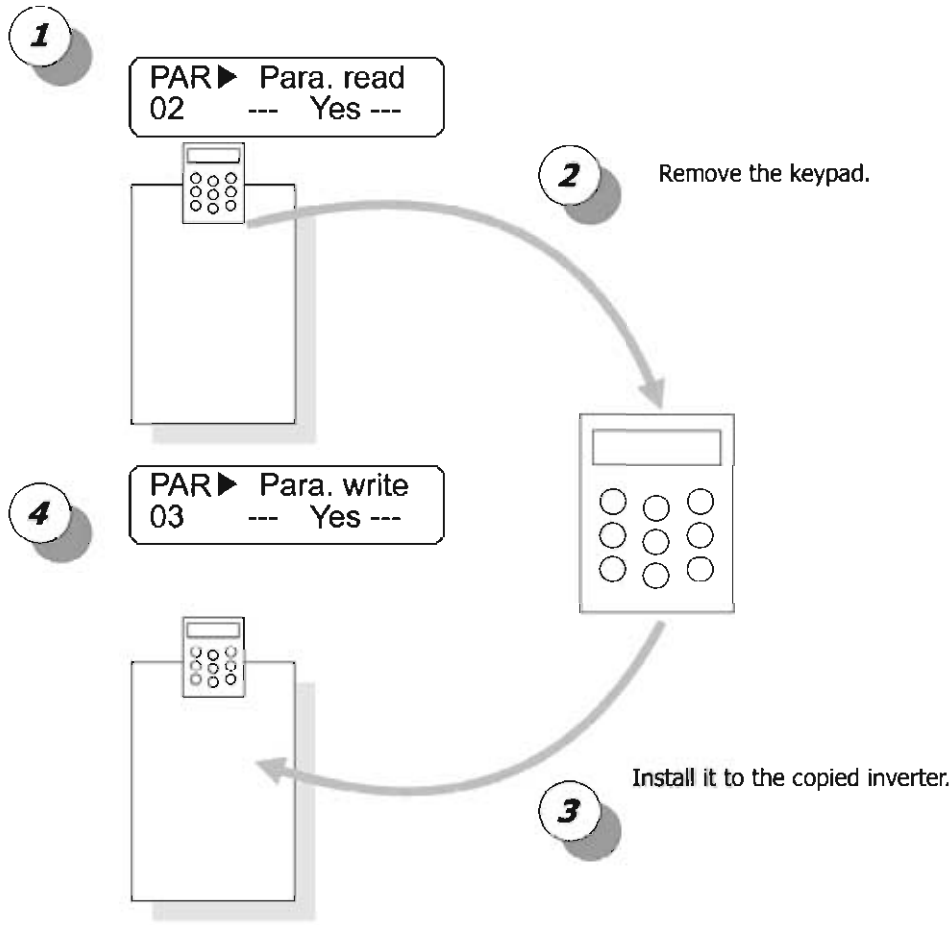
This is used to initialize all parameters or each group back to the factory defaults. After performing this, be sure to check **PAR_07 (Motor Select) is properly set.**

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_01 | Para. init | Initialize parameters as factory defaults | No<br>All Groups<br>DIS<br>DIO<br>PAR<br>FUN<br>CON<br>EXT<br>AIO<br>USR<br>2ND<br>E/L<br>SYN<br>WEB | | No |

**2) PAR_02 ~ 03 (All Parameter Read/Write)**

Parameters setting can be copied to other inverters using keypad. To do this, set **PAR_02** 'Parameter Read' to "Yes" to upload the parameter setting from the inverter. Take the keypad out and install it to the copied inverter and set **PAR_03** 'Parameter Write' to "Yes" to download the function parameters.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_02 | Para. Read | All Paramter Read | No/Yes | | No |
| PAR_03 | Para. Write | All Paramter Write | No/Yes | | No |






**3) PAR_04 (Parameter Lock)**

Set it to "12" to disable "paramter change".

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_04 | Para. Lock | Parameter lock | 0 ~ 255 | | 0 |

**4) PAR_05 (Password)**

When user put any four-digit number except "0" and cycle the power, only Display groupd will appear. Press [Mode] key and PAR_05 "Password" will be directed. If the right password is entered, all other groups can be accessed and adjustable. To clear the password, set it to "0". When you forget the password, enter "5052". It is the master password and it resets the password to "0".

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_05 | Password | Password | 0 ~ 9999 | | 0 |

### 6.3.3 Motor parameters setting

**1) PAR_07(Motor rating setting)**

**2) PAR_08(Motor cap. selection of user)**

Select the motor rating. Its factory default value is the same as inverter capacity. If this is set, motor parameters are automatically set. These are designed to fit for LG-OTIS vector motor. When other makers' motor is used, program the motor parameters properly. When using a motor having a rating not specified in this code, select "**User Define**". Then, PAR_08 will be displayed. Enter motor rating in this code. Then, enter motor parameters in the name plate and perform Auto-tuning to gain proper parameters before use.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_07 | Motor select | Motor rating select | 2.2 ~ 375.0<br>User Define | kW | Same as inverter rating |
| PAR_08 | UserMotorSel | Motor cap. Selection of User | 1.5 ~ 375.0 | kW | 5.5 |

**3) PAR_09 (Motor cooling method)**

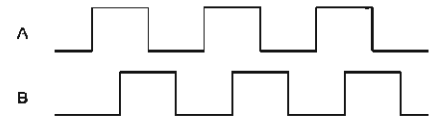
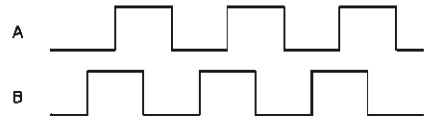
Select the cooling method of the motor to use. 'Motor cooling method' is used to check if the motor is currently overloaded or not. The self-cooled motor should be set to 'Self-Cool' and the forced cooled motor to 'Forced-Cool'.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_09 | Cooling Mtd | Motor Cooling method | Forced-cool<br>Self-cool | | Forced-cool |

**4) Encoder parameters (PAR_10 ~ 13: Pulse number of encoder, direction, error detection, LPF)**

Enter the pulse number of encoder mounted on the motor shaft at the **PAR_10 (the pulse number of encoder).** If **PAR_12(Encoder error check enable)** is set to '**Yes**', Encoder error signal is detected and then triggers fault alarm in the case of the wire cut or the miswiring. But, **for open collector type encoder, it is unable to detect the encoder error, therefore PAR_12 should be set to 'No'.** In case the wiring for encoder (A, B phase) or inverter output (U, V, W) is changed, '**Enc AB Chgd**' message is shown during the auto-tuning operation. In this case, **PAR_11 (Enc Dir Set)** can be changed without changing the wiring of pulse encoder. If encoder signal is mixed with electromagnetic noise signal, encoder signal may be less affected by the electromagnetic noise signal by adjusting **PAR_13** (**Encoder LPF Time Constant**).

| Code | LCD display | Description | Setting range | Factory setting |
|---|---|---|---|---|
| PAR_11 | Enc Dir Set | Encoder direction setting | A Phase Lead/B Phase Lead | A Phase Lead |

| Setting | Description | Encoder pulse (In FWD RUN) |
|---|---|---|
| A Phase Lead | A phase leads in FWD rotation.<br>B phase leads in REV rotation. |  |
| B Phase Lead | B phase leads in FWD rotation.<br>A phase leads in REV rotation. |  |

If you set "Enc Err Chk" of PAR_12 to "Yes", when there is disconnection or misconnection of encoder, encoder error is detected and show the encoder abnormity sign. In the case of open collector method of encoder, it isn't possible to detect encoder error. So set PAR-12 to "No".

Improper setting of encoder parameters may deteriorate accurate speed control and lead to "overcurrent" or "overvoltage" trips. Refer to chapter 9 "Troubleshooting".

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_10 | Enc Pulse | Number of encoder pulse | 360 ~ 4096 | | 1024 |
| PAR_12 | Enc Err Chk | Encoder error check | Yes<br>No | | Yes |
| PAR_13 | Enc LPF | Encoder LPF time constant | 0 ~ 100 | ms | 1 |

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### 6.3.4 Encoder S/W error detection (PAR_14 ~ 15: Encoder error detection time, encoder error reference speed)

To achieve correct motor speed detection and control using encoder, proper wiring of encoder and motor should be preceded. If operation is continued with faulty wiring of Encoder/Motor, overcurrent flows to the motor, damaging the motor. Therefore, encoder should have functions to detect encoder input error and wrong wiring.

SV-iV5 can monitor encoder H/W error by setting PAR_12 to "Yes" and it monitors encoder pulse signal input status to detect H/W faults such as encoder disconnection error. However, wrong wiring error cannot be detected with this function. In this case, perform "Rotational Auto-tuning". Set PAR_23 (AutoTuneType) to "Rotational" and perform Encoder Test. Then wiring problem can be detected by applying voltage and checking speed detection level while motor is running.

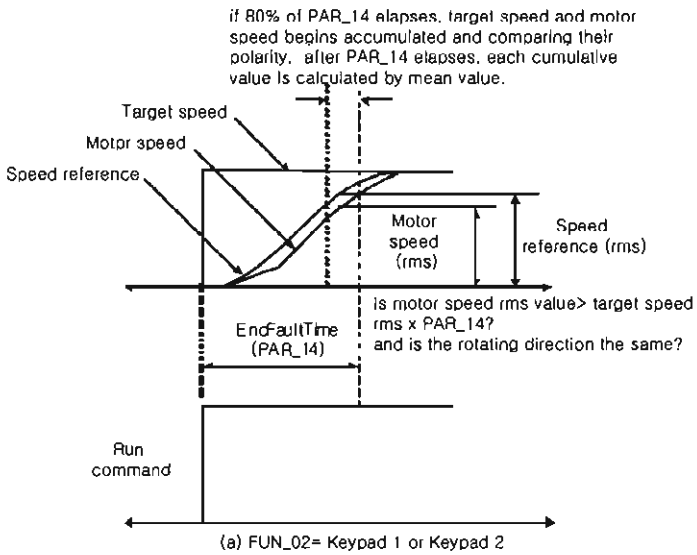
There are some loads (ex. Elevator) performing Encoder Test described above is difficult. To solve this fault, iV5 adopts the following functions to detect S/W faults.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_14 | EncFaultTime | Encoder error detection time | 0.00 ~ 10.00 | sec | 0.00 |
| PAR_15 | EncFaultPerc | Encoder error reference speed | 0.0 ~ 50.0 | % | 25.0 |
| PAR_21 | Rated-Slip | Motor rated slip | 10 ~ 250 | rpm | |

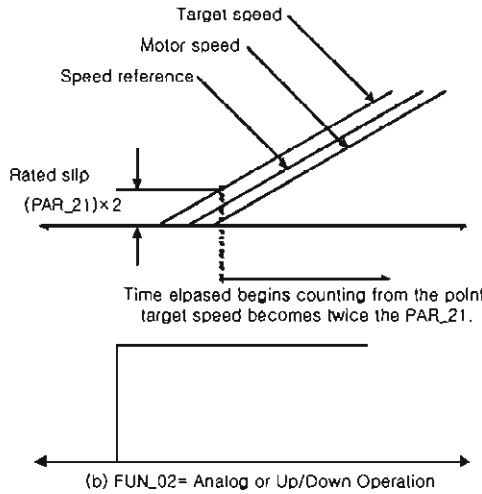
When encoder/motor wiring is reversed, motor cannot perform acceleration due to overcurrent. Encoder S/W error detection is adopted to detect the errors such as wrong wiring and incorrect pulse input during normal operation, not during Auto-tuning. Inverter determines encoder error if motor speed is not accelerated proportional to operating time and target speed after PAR_14 EncFaultTime elapses and polarity does not match.

To activate S/W error detection function, set CON_01 = Speed, Auto Tuning is not selected and set EncFaultTime except 0. If run command is removed before "EncFaultTime" elapses or acceleration is turned to deceleration due to target speed change, inverter cannot detect encoder S/W error. Inverter determines encoder S/W error by comparing motor speed and Target speed XEncFaultPerc while operation status is acceleration after EncFaultTime elapses.

Encoder S/W error detection is performed only once after operation starts and activates when target speed becomes twice the rated slip. For example, when target speed is 500(rpm) and rated slip is 40(rpm), the detection active level is 80(rpm).


if 80% of PAR_14 elapses, target speed and motor speed begins accumulated and comparing their polarity. after PAR_14 elapses, each cumulative value is calculated by mean value.
Target speed
Motor speed
Speed reference
Motor speed (rms)
Speed reference (rms)
EncFaultTime (PAR_14)
Is motor speed rms value> target speed rms x PAR_14?
and is the rotating direction the same?
Run command

(a) FUN_02= Keypad 1 or Keypad 2




(b) FUN_02= Analog or Up/Down Operation

### 6.3.5 Auto-tuning

The motor parameters for the Vector Control are autotuned by Starvert-iV5. The stator resistance, Stator Inductance, Leakage Inductance and Rotor time constant are found and saved. User can select the type of Auto-tuning in Rotational or Standstill mode.

**1) Motor and encoder parameters setting for auto-tuning**

The following paramters should be set according to motor nameplate to find motor parameters correctly.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_07 | Motor Select | Motor capacity selection | 2.2 ~ 375.0<br>User Define | | |
| PAR_08 | UserMotorSel | Motor cap. selection of USER | 1.5 ~ 375.0 | | 5.5 |
| PAR_10 | Enc Pulse | Pulse no. of encoder | 360 ~ 4096 | | 1024 |
| PAR_17 | Base Speed | Motor base speed | 100.0 ~ 3600.0 | rpm | 1800.0 |
| PAR_18 | Rated Volt | Motor rated voltage | 120 ~ 560 | V | 220 or 440 |
| PAR_19 | Pole Number | Motor number of poles | 2 ~ 12 | | 4 |
| PAR_20 | Efficiency | Motor efficiency | 0.0 ~ 100.0 | % | |
| PAR_21 | Rated-Slip | Motor rated slip | 10 ~ 250 | rpm | |
| PAR_22 | Rated-Curr | Motor rated current | 1.0 ~ 750.0 | A | |

**PAR_17 "Motor base speed"** is the frequency inverter outputs its rated voltage. It is to be set within the range of Motor Max speed. **Set motor speed and rated voltage according to motor rating.** When standard motor is used, 60Hz (1800rpm) is the normal rating. The base speed of motor is $rpm = \frac{120 \times \text{Base Frequency}}{\text{Pole Number}}$

In the case of standard moto, $1800rpm = \frac{120 \times 60Hz}{4}$

**PAR_18 "Motor rated voltage"**

**For** 200V class inverters, factory default is 220(V) and for 400V class is 440(V). When input voltage is 380(V), change it to 380V. This value is input to Voltage controller and used to prevent voltage saturation. It should be set correctly because it affects Flux current value during Auto-tuning.

**PAR_20 "Motor efficiency" should be entered for** (PAR_23[AutoTuneType] : StandStill), not needed for (PAR_23 [AutoTuneType] : Rotational).

**PAR_21 "Motor rated slip"**

It is calculated by Motor speed – Motor nameplate rated speed. For example, Motor speed is 1800(rpm) with 1740(rpm) rated speed. Then, Motor rated slip would be 60(rpm).

### 2) Rotational auto-tuning

#### 2.1) Precaution

> **⚠ CAUTION**
>
> Be sure to remove the load connected to the motor shaft before performing rotational auto-tuning. Otherwise, it may lead to damage to the motor or bodily injury. DB resistor should be installed because the inverter repeats abrupt Accel/Decel many times to find the motor constant (Tr) during tuning.

#### 2.2) Parameter setting

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| **PAR_23** | **AutoTuneType** | Auto tuning type selection | Rotational<br>StandStill | | **Rotational** |
| PAR_24 | Auto Tuning | Auto tuning range setting | None<br>ALL1<br>ALL2<br>Encoder Test<br>Rs Tuning<br>Lsigma<br>Flux Curr<br>Ls Tuning<br>Tr Tuning | | None |
| PAR_25 | Tune Torque | Tuning Torque | 10.0 ~ 100.0 | % | 70 |

There are 8 types of auto-tuning selection for Rotational mode.

- ALL2: Rs→ Lsigma→ Flux Current→ Ls→ Tr
- ALL1: Encoder test →Perform ALL2

Rs, Lsigma, Flux Current, Ls, Tr: Perform each parameter seperately. Tr follows Rs, Ls auto-tuning to find exact value. To save tuning time, increase PAR_25 "Tuning torque for Auto-tuning" when load inertia is high during Tr tuning. FWD/REV LED is blinking during auto-tuning.

| Auto-tuning type | Description |
|---|---|
| None | No Operation |
| ALL1 | Rs, Lσ, I Flux, Ls, Tr are tuned continuously after Encoder test |
| ALL2 | Rs, Lσ, I Flux, Ls, Tr are tuned continuously except Encoder Test |
| Encoder Test | Encoder Test Only<br>The motor is rotating at 1500 rpm in forward direction and the encoder wiring status is checked. |
| Rs Tuning | Rs tuning Only. The stator resistance is tuned at standstill. |
| Lsigma | Lsigma tuning Only. The Leakage Inductance is tuned at standstill. |
| Flux Curr | Flux current Only.<br>The motor is rotating at 1500 rpm and finds Flux current. |
| Ls Tuning | Ls Only.<br>The motor is rotating at 1500 rpm and finds Rotor Inductance. |
| Tr Tuning | Tr Only<br>The motor is ramping UP and DOWN continuously.<br>But tuning time can vary. It should be autotuned after Rs, Lσ, and Ls. |

### 2.3) Rotational auto-tuning procedure

| LCD display | Description | Tuning time |
|---|---|---|
| PAR ▶ AutoTuneType<br>23 Rotational | Set it to " **Rotational** ". | - |
| PAR ▶ Auto tuning<br>24 ALL1 | Auto-tuning starts when it is set to " **ALL1** ". | - |
| PAR ▶ Auto tuning<br>24 Enc Testing | Checks whether the encoder wiring is properly done and an encoder works well by rotating the motor at base speed in forward direction. | 30~35(Sec) |
| PAR ▶ Auto tuning<br>24 Rs Tuning | Stator resistance (Rs) is measured without rotating the motor. | 10~20(Sec) |
| PAR ▶ Auto tuning<br>24 sL Tuning | The leakage inductance (sL) of the motor is measured without rotating the motor. | 5 ~ 20(Sec) |
| PAR ▶ Auto tuning<br>24 IF Tuning | The flux current (IF) is measured by rotating the motor at base speed. | 30~60(Sec) |
| PAR ▶ Auto tuning<br>24 Ls Tuning | Stator self-inductance (Ls) is measured by rotating the motor at base speed. | 50~60(Sec) |
| PAR ▶ Auto tuning<br>24 Tr Tuning | Accel/Decel is performed repeatedly to find motor constant (Tr) so that DB Resistor should be connected before starting tuning. Otherwise, "Over Voltage " trip will occur. | 20~60(Sec) |
| PAR ▶ Auto tuning<br>24 None<br><br>PAR ▶ Auto tuning<br>24 [][] Error | When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative. | **Total: 3 ~ 5 (Min.)** |

### 3) Standstill auto tuning

#### 3.1) Precaution

Be sure to lock the motor shaft using magnetic brake to find motor parameters correctly.

#### 3.2) Parameter setting

| | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| **PAR_23** | **AutoTuneType** | Auto tuning type selection | Rotational<br>StandStill | | **StandStill** |
| PAR_24 | Auto Tuning | Auto tuning range setting | None<br>ALL1<br>Rs Tuning<br>Lsigma<br>If/Tr/Ls Tune | | None |

There are 4 modes for Standstill auto-tuning.

ALL1: Rs→ Lsigma→ If→ Ls→Tr

Rs Tuning, Lsigma, If/Tr/Ls Tune: Perform each parameter seperately.

| Auto-tuning type | Description |
|---|---|
| None | No Operation |
| ALL1 | Rs, Lσ, If/Tr/Ls are tuned continuously except Encoder Test |
| Rs Tuning | Rs tuning Only. The stator resistance is tuned at standstill. |
| Lsigma | Lσ, tuning Only. The Leakage Inductance is tuned at standstill. |
| If/Tr/Ls Tune | Finds If/Tr/Ls by applying DC current pulse. |

- **FWD/REV LEDs are blinking during auto-tuning.**

### 3.3) StandStill type auto-tuning procedure

| LCD Display | Description | Tuning Time |
|---|---|---|
| PAR ▶ AutoTuneType<br>23 StandStill | Set the auto-tuning type to "**Standstill**". | - |
| PAR ▶ Auto tuning<br>24 ALL1 | Auto-tuning starts if **ALL1** is set. | - |
| PAR ▶ Auto tuning<br>24 Rs Tuning | Stator resistance (Rs) is measured without rotating the motor. | 20-30 Sec |
| PAR ▶ Auto tuning<br>24 sL Tuning | The leakage Inductance (sL) of the motor is measured without rotating the motor. | 90-150 Sec |
| PAR ▶ Auto tuning<br>24 If/Tr/Ls Tuning | Flux current (IF), rotor time constant ( τ r) and stator self-inductance (Ls) is measured simultaneously without rotating the motor. | 40-70 Sec |
| PAR ▶ Auto tuning<br>24 None<br><br>PAR ▶ Auto tuning<br>24 [][] Error | When auto-tuning is complete successfully, "None" is displayed. If error occurs during auto-tuning, "[][] Error" is displayed. In this case, verify motor parameters and encoder setting is done properly and redo the auto-tuning. If the problem persists, contact LS representative. | **Total: 3-5 minutes** |

#### 4) Motor parameters

The following parameters are found during Auto-tuning.

Motor parameters described below are entered based on LG-OTIS vector motor.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_26 | Flux-Curr | Motor flux current | 0.0 ~ 70% of motor rated current | A | |
| PAR_27 | Tr | Rotor time constant | 30 ~ 3000 | ms | |
| PAR_28 | Ls | Leakage inductance | 0.00 ~ 500.00 | mH | |
| PAR_29 | Lsigma | Leakage coefficient | 0.00 ~ 100.00 | mH | |
| PAR_30 | Rs | Stator resistance | 0.000 ~ 5.000 | ohm | |

Additional functions are as follows;

- User can stop tuning during tuning using [STOP] key.
- In case Encoder test is failed, inverter does not conduct Rs tuning and displays "Encoder Err".
  If this happens, press [Reset] key and retry Encoder test.
- Tr Tuning result can be slightly different for times. Perform it couple of times.

**5) Auto tuning error message**

| LCD Display | Description and Solution |
|---|---|
| PAR▶ Auto tuning<br>24 Enc Error | Displayed when phase loss of A or B occurs and/or error between reference speed and encoder feedback speed exceeds motor rated slip. Check whether wiring of encoder power (PE, GE) and A/B phase is conducted correctly. |
| PAR▶ Auto tuning<br>24 Enc AB Chgd | Displayed in case of reverse wiring of phase A/B or U, V, W. Wire the U, V, W in a correct order or change the encoder direction setting to "B Phase Lead" in PAR_11. |
| PAR▶ Auto tuning<br>24 Rs Error | Displayed when RS value is greater than 5[Ω] or less than 0.002[Ω]. Check for wiring of inverter and motor and motor damage. It may occur when motor rating is much lower than that of inverter. |
| PAR▶ Auto tuning<br>24 sL Error | Displayed when sL is higher than 100[mH]. Check for wiring of inverter and motor and motor damage. |
| PAR▶ Auto tuning<br>24 IF Error | Displayed when motor rpm exceeds 1650 rpm (1800 rpm rated motor) during flux current calculation or flux current is not measured for a long time. Check for wiring of inverter and motor and number of motor phase. |
| PAR▶ Auto tuning<br>24 Ls Error | Displayed when motor rpm exceeds 1650 rpm (1800 rpm rated motor) during Ls calculation or Ls is not measured for a long time. Check for wiring of inverter and motor and number of motor phase. |
| PAR▶ Auto tuning<br>24 PAR 27 DOWN | Displayed when initial set value of PAR_27 is set too high. Repeat the calculation after lowering 30% to initial value. |
| PAR▶ Auto tuning<br>24 PAR 27 UP | Displayed when initial set value of PAR_27 is set too low. Repeat the calculation after increasing 30% to initial value. |

## 6.4 Function group (FUN_[][])

### 6.4.1 Jump code (FUN_00)

Jumping directly to any parameter code can be accomplished using FUN_00 [Jump code].

Press [PROG] key first and set 2 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to FUN_02. If the desired code cannot be accessed or void, it automatically jumps to closest code.

After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

### 6.4.2 Operating method select

#### 1) FUN_01(RUN/STOP source select)

There are four methods for issuing RUN/STOP command of the motor.

- Terminal 1/ Terminal 2: Digital input of the FX/RX terminal
- Keypad: [FWD], [REV], [STOP] key on the keypad
- Option: using Option card. (Factory setting: Terminal 1)

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_01 | Run/Stop Src | RUN/STOP source select | Terminal 1<br>Terminal 2<br>Keypad<br>Option | | Terminal 1 |

Difference between Terminal 1 and Terminal 2 setting

| Run/Stop source select | Terminal ON/OFF | | FWD/REV select |
|---|---|---|---|
| Terminal 1 | FX | ON | FWD run command |
| | | OFF | Stop command |
| | RX | ON | REV run command |
| | | OFF | Stop command |
| Terminal 2 | FX | ON | Run command |
| | | OFF | Stop command |
| | RX | ON | REV rotation |
| | | OFF | FWD rotation |

For Analog speed setting, applying (+) Voltage marks FWD Run command and (-) voltage REV Run command.

| Analog speed setting range | FX / FWD / Option FWD | RX / REV / Option REV |
|---|---|---|
| 0 ~ +10 V | Forward direction | Reverse direction |
| -10 ~ 0 V | Reverse direction | Forward direction |

**2) FUN_02 (Speed setting method)**

There are four methods to set operating speed.

- Keypad 1/Keypad 2: Digital setting via keypad
- Analog: speed setting via analog input terminal define
- Option: speed setting via option card

To change speed reference in Keypad 1 method, change the value in FUN_12 Speed 0 using [▲(Up)], [▼(Down)] key and press [ENT] key to enter the value into memory. However, in Keypad 2, the changed value is reflected real-time without pressing [ENT] key.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_02 | Spd Ref Src | Speed setting method | Analog<br>Keypad 1<br>Keypad 2<br>Option | | Keypad 1 |

**3) FUN_03 (Stop method)**

This determines the stop mode of the motor. If this is set to 'Decel' and then stop command is ON, the motor decelerates to a stop within the deceleration time set at FUN_39 (Deceleration Time 1). But, if the motor does not stop within the deceleration time, it is freely rotating after the deceleration time. If this is set to 'Free-run' and then stop command is ON, the motor freely rotates immediately.



| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_03 | Stop Mode | Stop method | Decel<br>Free-run | | Decel |

### 6.4.3 Motor max speed setting

Maximum value of the speed command to the motor is set to the sum of setting speed, reference speed in Draw control , reference speed in Process PID control and reference speed in Droop control. In this case, final speed command output is limited to the maximum speed command to the motor.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_04 | Max Speed | Max. motor speed | 400.0 ~ 3600.0 | rpm | 1800.0 |

### 6.4.4 Multi-step speed and Dwell speed setting methods

**1) FUN_12 ~ 19(Multi-step speed 0 ~ 7)**

**2) FUN_20(JOG speed command)**

If the multi-function terminal is selected as a multi-step speed setting or jog operation, the speed command is determined by the combination of multi-function terminals P1 to P7 and jog speed command.

Multi-speed command by the combination of P1, P2 and P3 is generated as follows. In case multi-step speed 0 is selected (P1, P2 and P3 all are OFF), One of the speed commands from the keypad, analog voltage input and option board is fed into the inverter. In case P4 is ON, it ignores the speed command selection by other terminals and jog

operation command has a priority. In this case, the motor is operated at the speed of FUN_20 (Jog speed command).

| P1 | P2 | P3 | P4 | Setting speed |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | Speed command source is selected at FUN_02. (One of analog inputs, FUN_12 and Option board) |
| ON | OFF | OFF | OFF | FUN_13 |
| OFF | ON | OFF | OFF | FUN_14 |
| ON | ON | OFF | OFF | FUN_15 |
| OFF | OFF | ON | OFF | FUN_16 |
| ON | OFF | ON | OFF | FUN_17 |
| OFF | ON | ON | OFF | FUN_18 |
| ON | ON | ON | OFF | FUN_19 |
| X | X | X | ON | FUN_20 (JOG speed command) |

The values of the multi-step speed command are shown below.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_12 | Speed 0 | Multi-step speed 0 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_13 | Speed 1 | Multi-step speed 1 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_14 | Speed 2 | Multi-step speed 2 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_15 | Speed 3 | Multi-step speed 3 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_16 | Speed 4 | Multi-step speed 4 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_17 | Speed 5 | Multi-step speed 5 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_18 | Speed 6 | Multi-step speed 6 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_19 | Speed 7 | Multi-step speed 7 | 0.0 ~ FUN_04 | rpm | 0.0 |
| FUN_20 | Jog Speed | JOG speed | 0.0 ~ FUN_04 | rpm | 100.0 |

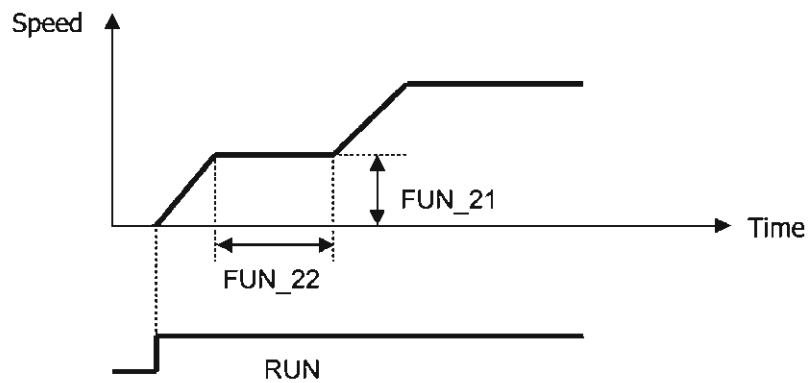
- FUN_04: Max. motor speed

### 3) FUN_21(Dwell Speed), FUN_22(Dwell Time)

Acceleration is instantly stopped and restarted before driving a heavy load such as hoists when selected.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_21 | Dwell Speed | Dwell Speed | 0.0 ~ FUN_04 | rpm | 100.0 |
| FUN_22 | Dwell Time | Dwell Time | 0.00 ~ 100.00 | sec | 0.00 |

- FUN_04: Maximum motor speed
- disabled when FUN_22 is set to "0".

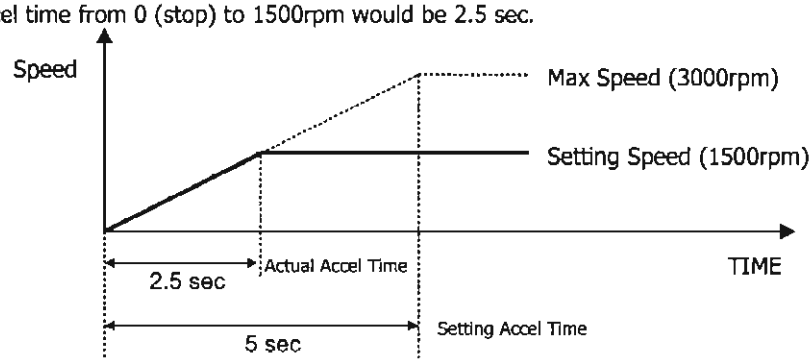


### 6.4.5 Accel/Decel pattern and time selection

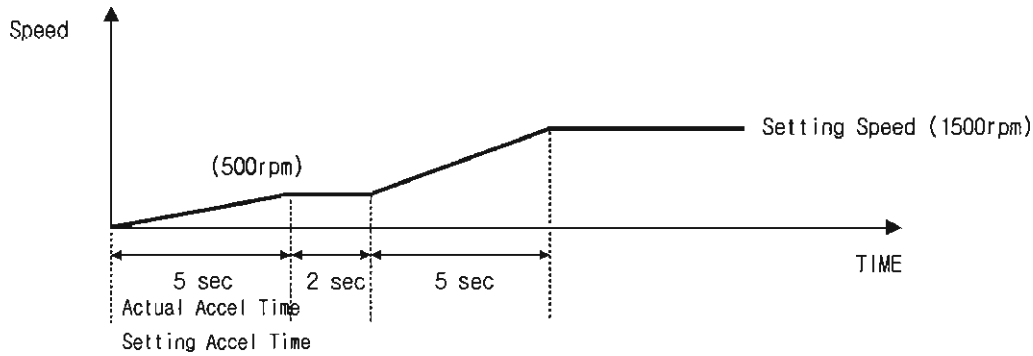
#### 1) FUN_33 (Accel/Decel reference speed)

Acceleration time, deceleration time and BX time is set on the basis of the value at **FUN_33(Accel./decel. reference speed)**, which is 'Max speed'or 'Ref speed'.

Setting example 1 if FUN_33= "Max Speed", Max motor speed= 3000rpm and Operating speed= 1500rpm, Accel time= 5 sec, accel time from 0 (stop) to 1500rpm would be 2.5 sec.




Setting example 2 If FUN_33 is set to 'Ref Speed' and speed command and acceleration time is set to 1500rpm and 5 seconds, respectively, it takes 5 seconds to accelerate from the standstill to 1500rpm.



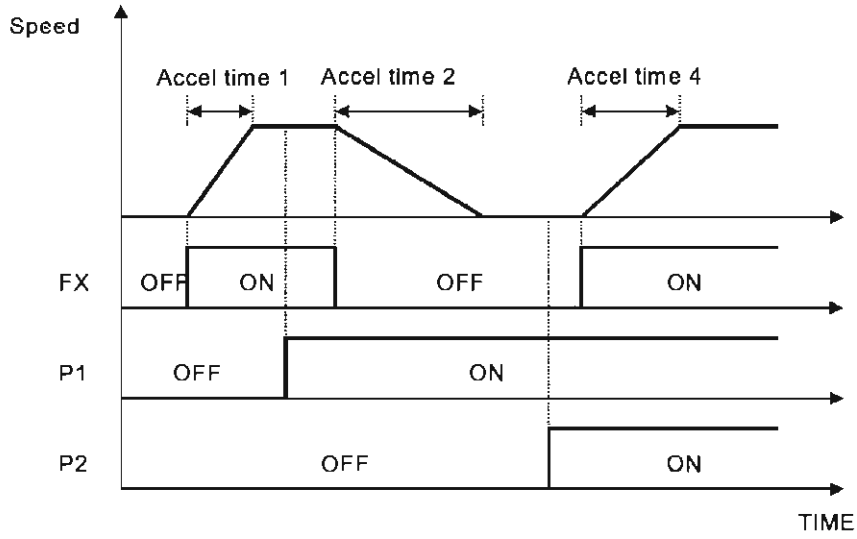

#### 2) FUN_40 ~ 47(Accel/Decel time 1 ~ 4)

Accel/Decel time 1-4 can be set in SV-iV5 as shown below.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_40 | Acc Time-1 | Acceleration time 1 | 0.00 ~ 6000.0 | sec | 2.00 |
| FUN_41 | Dec Time-1 | Deceleration time 1 | 0.00 ~ 6000.0 | sec | 2.00 |
| FUN_42 | Acc Time-2 | Acceleration time 2 | 0.00 ~ 6000.0 | sec | 3.00 |
| FUN_43 | Dec Time-2 | Deceleration time 2 | 0.00 ~ 6000.0 | sec | 3.00 |
| FUN_44 | Acc Time-3 | Acceleration time 3 | 0.00 ~ 6000.0 | sec | 4.00 |
| FUN_45 | Dec Time-3 | Deceleration time 3 | 0.00 ~ 6000.0 | sec | 4.00 |
| FUN_46 | Acc Time-4 | Acceleration time 4 | 0.00 ~ 6000.0 | sec | 5.00 |
| FUN_47 | Dec Time-4 | Deceleration time 4 | 0.00 ~ 6000.0 | sec | 5.00 |

**(Example)** Programming P1, P2 as Xcel-L and Xcel-H

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| DIO_01 | P1 define | Definition of P1 input | | | Xcel – L |
| DIO_02 | P2 define | Definition of P2 input | | | Xcel – H |



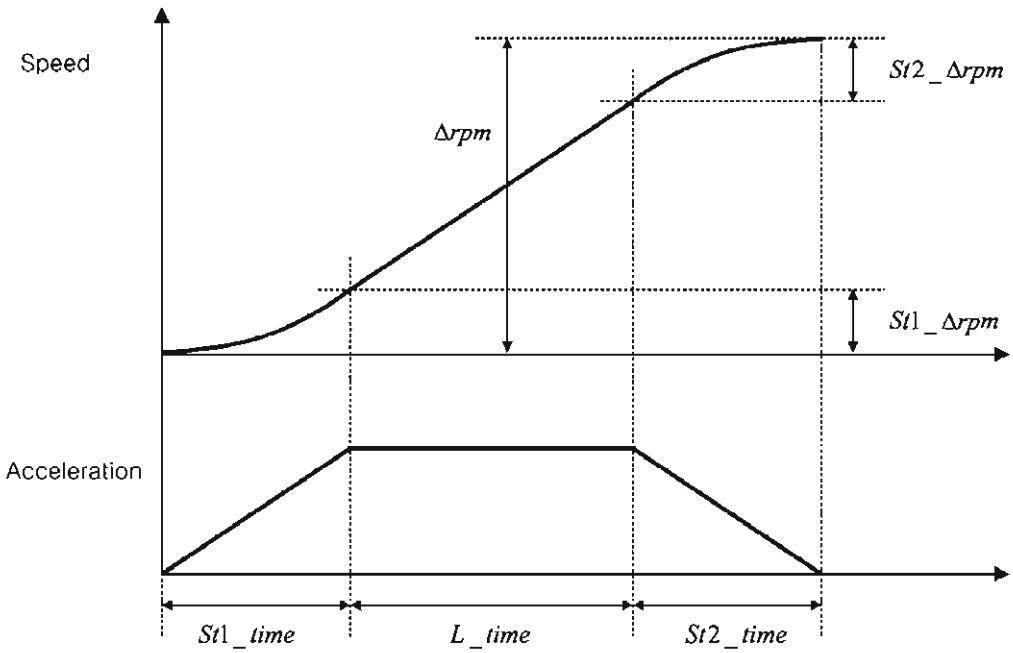

| P1 (Xcel-L) | P2 (Xcel-H) | P3 (SoftStartCncl) | Accel/Decel time |
|---|---|---|---|
| OFF | OFF | OFF | Accel/Decel 1 |
| ON | OFF | OFF | Accel/Decel 2 |
| OFF | ON | OFF | Accel/Decel 3 |
| ON | ON | OFF | Accel/Decel 4 |
| X | X | ON | Max Accel/Decel |

**3) FUN_36 ~ 39(S curve ratio during Accel/Decel 1 ~ 2)**

The ramping pattern of the Linear and S Curve could be used by setting the parameters below. S Curve pattern is used to control the acceleration of the machine as linear to minimize the shock at the start. The parameters, FUN_36 ~ 39 determine the rate of S Curve pattern as in the figure below. FUN_36, 37 are applied in the acceleration and FUN_38, 39 in the deceleration.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_36 | Acc S Start | Curve ratio at the beginning of acceleration | 0.0 ~ 50.0 | % | 0.0 |
| FUN_37 | Acc S End | Curve ratio at the end of acceleration | 0.0 ~ 50.0 | % | 0.0 |
| FUN_38 | Dec S Start | Curve ratio at the beginning of deceleration | 0.0 ~ 50.0 | % | 0.0 |
| FUN_39 | Dec S End | Curve ratio at the end of deceleration | 0.0 ~ 50.0 | % | 0.0 |

- **Programming example of S curve pattern**






- **Basic equation**

*St1_time = AccTime * (FUN_36 / 50.0%)*

*St2_time = AccTime * (FUN_37 / 50.0%)*

*St1_Δrpm = St1_time * (MaxSpeed / AccTime) * 0.5*

*St2_Δrpm = St2_time * (MaxSpeed / AccTime) * 0.5*

- **Calculation 1**

$\Delta rpm \geq St1\_\Delta rpm + St2\_\Delta rpm$

Δrpm = The difference between the current speed and the target speed

$L\_time = (\Delta rpm - St1\_\Delta rpm - St2\_\Delta rpm) * (AccTime / MaxSpeed)$

$Effective\ Acceleration\ Time = St1\_time + L\_time + St2\_time$

- **Calculation 2**

$\Delta rpm < St1\_\Delta rpm + St2\_\Delta rpm$

$St1'\_time = \sqrt{\{[\Delta rpm * AccTime^2 * St1\_time^2] / [25 * MaxSpeed * (St1\_time + St2\_time)]\}}$

$St2'\_time = \sqrt{\{[\Delta rpm * AccTime^2 * St2\_time^2] / [25 * MaxSpeed * (St1\_time + St2\_time)]\}}$

$Effective\ Acceleration\ Time = St1'\_time + St2'\_time$

*Δrpm*: Speed difference
*MaxSpeed* : Maximum speed ( FUN_04 )
*AccTime* : Set acceleration time (FUN_40, 42, 44, 46)
*St1_Δrpm*: Acc S Start ST (%) of FUN_36 at the time of acceleration,
Dec S End ST (%) of FUN_39 at the time of deceleration
*St2_Δrpm*: Acc S End ST (%) of FUN_37 at the time of acceleration,
Dec S Start ST (%) of FUN_38 at the time of deceleration
*St1_time*: The time when St1_Δrpm is formed.
*St2_time*: The time when St2_Δrpm is formed.

**4) FUN_48 (Deceleration time for zero speed selection)**

**5) FUN_49 (Zero speed deceleration time)**

This is the time when the motor decelerates from the arbitrary speed to 0 rpm in speed. This is valid only when FUN_48 is set to 'Yes'. If 'No' is set, the set deceleration time is applied.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_48 | Use 0 Dec T | Deceleration time selection for zero speed | No/Yes | | No |
| FUN_49 | 0 Dec Time | Deceleration time for zero speed | 0.00~6000.0 | sec | 0.00 |

### 6) FUN_51(Decel time when BX is ON)

When the motor should be stopped immediately in case of emergency, BX on the control circuit terminal can be used. When BX is ON, the motor decelerates to a stop within 'Emergency deceleration time' set at FUN_51. But, if the motor does not stop within the deceleration time, it rotates freely after the deceleration time. If the motor is intended to stop at the instant BX is ON, FUN_51 is set to '0'.

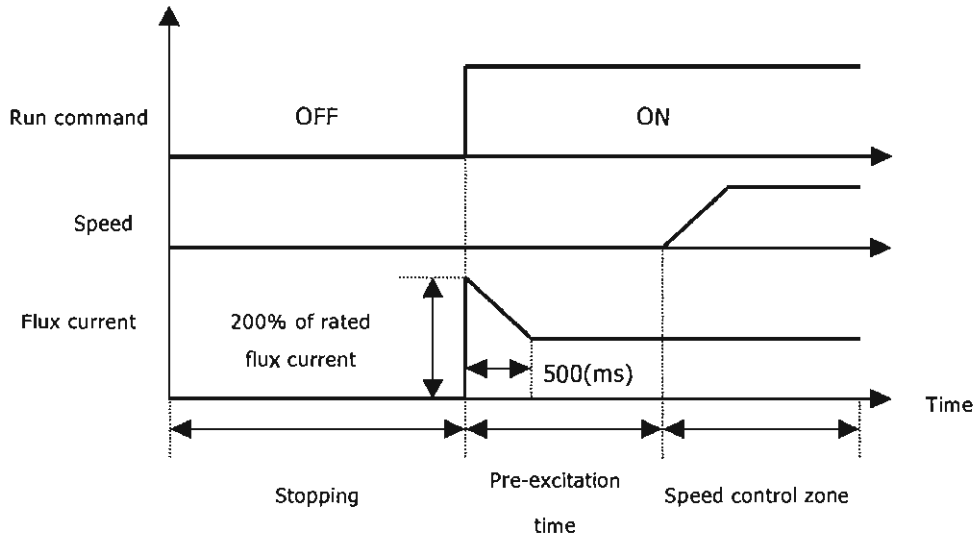
| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_51 | BX Time | Deceleration time for emergency stop | 0.0 ~ 6000.0 | sec | 0.0 |

### 7) FUN_52 (Pre-excitation)

FUN_52 (Motor Pre-excitation Time) can be used for the flux build-up in the induction motor to obtain the best control characteristic.

- **FUN_52 is activated only when FUN_02(Spd Ref Sel) is set to Keypad1 or Keypad2.**

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_52 | PreExct Time | Pre-excitation time | 0 ~ 10000 | ms | 0 |




### 8) FUN_53(Hold Time)

The motor maintains the zero speed for 'Motor Hold Time' after the motor decelerates to a stop.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_53 | Hold Time | Motor Hold Time | 100 ~ 10000 | ms | 1000 |

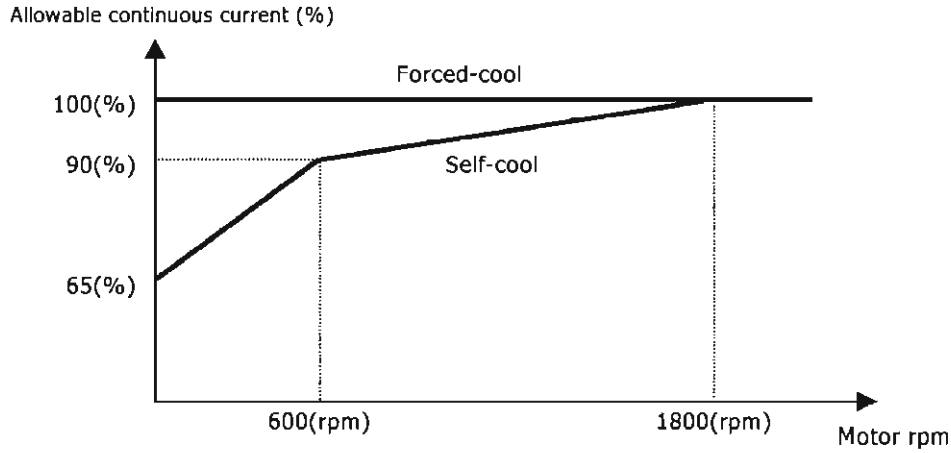
### 6.4.6 Electronic thermal (motor $I^2T$) selection

These functions are required when the motor should be protected against the overheat without installing the thermal relay between the inverter and the motor. If electronic thermal protection is ON, the inverter blocks the IGBT gating signals and issues the trip message.

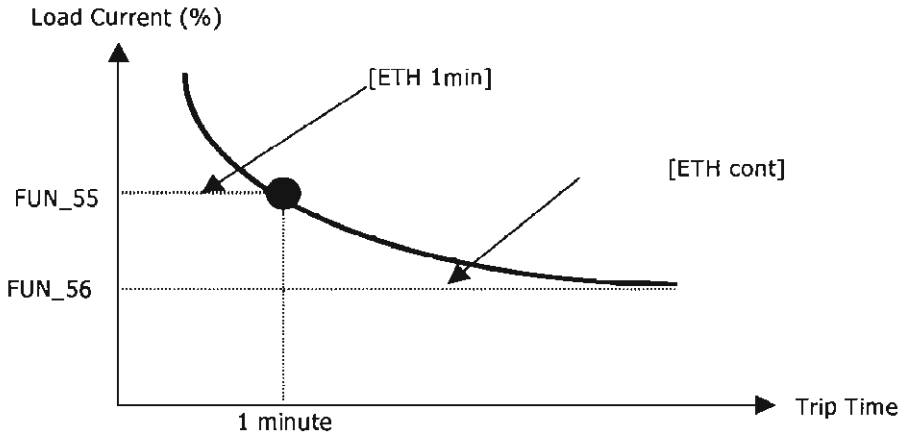
| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_54 | ETH Select | Electronic thermal selection | No<br>Yes | | No |
| FUN_55 | ETH 1 Min | Electronic thermal level for 1 minute | FUN_56 ~ 200 | % | 150 |
| FUN_56 | ETH Cont | Electronic thermal level for continuous | 50 ~ FUN_55 (up to 150%) | % | 100 |
| PAR_09 | Cooling Mtd | Motor cooling method | Self-cool<br>Forced-cool | | Forced-cool |

Electronic thermal protection level is set in % based on the **'Motor rated current'** at PAR_22. **'1 min.level of electronic thermal'** at FUN_55 is the current level which should be referred to when the motor is operated for a minute and the motor is estimated to be overheated. **'Continuous level of electronic thermal'** at FUN_56 is the current level which should be referred to when the motor is operated continuously and the motor is estimated to be in thermal equilibrium. Continuous level is set to the motor rated current (100%) and should be less than **'1 min.level of electronic thermal'** at FUN_55. PAR_09 'Cooling type' should be set correctly to ensure the proper electronic thermal protection.

- **Self-cool** : This should be set when cooling fan mounted on the motor shaft is used for cooling. The cooling performance is greatly reduced when the motor is operated at the low speed. Compared to high speed region, the motor is rapidly overheated at the low speed region even if the same current flows into it. So like the graph below, according to frequency, the allowable continous current value of **'Continuous level of electronic thermal'** of FUN_56 is reduced and electronic thermal function starts operating.
- **Forced-cool** : This should be set when the cooling fan is powered by the separate power supply. **'Continuous level of electronic thermal'** at FUN_56, which is allowable continuous current is applied, regadless of the operating frequency.




[The characteristic of allowable continuous current with respect to 4 pole, 60Hz motor]




[Motor i2t Characteristic Curve]

- The motor protection is possible by calculating and accumulating $I^2t$ even in load variation and frequent run/stop.

### 6.4.7 Inverter switching frequency select

#### 1) FUN_57 (Inverter switching frequency select)

This parameter affects the audible sound of the motor, noise emission from the inverter, inverter termperature, and leakage current. If the ambient temperature where the inverter is installed is high or other equipment may be affected by potential inverter noise, set this value lower. (setting range: 2.5 ~ 10.0 kHz).

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_57 | PWM Freq | Switching frequency select | | kHz | |

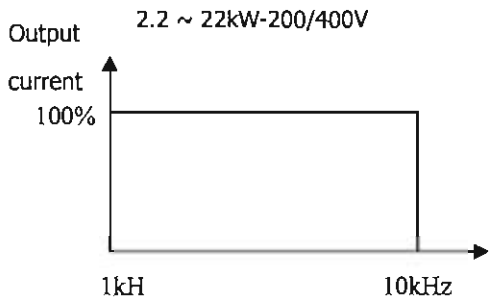
**2) Setting range and factory setting of switching frequency**

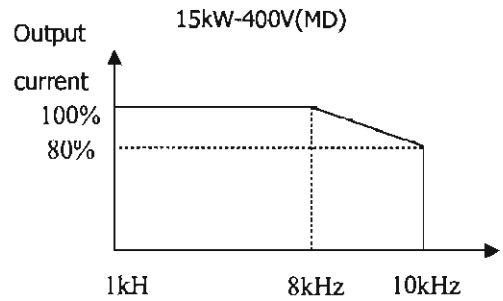
| Voltage | Inverter capacity (kW) | Setting range (kHz) | Factory setting (kHz) |
|---|---|---|---|
| 200V | 2.2 ~ 22(kW) | 2.5 ~ 10(kHz) | 10(kHz) |
| | 30/37(kW) | 2.5 ~ 7(kHz) | 5(kHz) |
| 400V | 2.2 ~ 22(kW) | 2.5 ~ 10(kHz) | 8(kHz) |
| | 30 ~ 75(kW) | 2.5 ~ 7(kHz) | 5(kHz) |
| | 90 ~ 132(kW) | 2.5 ~ 5(kHz) | 4(kHz) |
| | 160/220(kW) | 2.5 ~ 4(kHz) | 4(kHz) |
| | 280 ~ 375 (kW) | 2(kHz) | 2(kHz) |

- **Continuous Operation Derating Information**

15kW-400V(MD) class model among 5.5 ~ 22kW-200/400V class models applies the following load rating.

① Rated load classified by the switching frequency




② The above graph is only applied when the inverter is operated in the allowable temperature. Pay attention to the air cooling when the inverter is installed in a panel box, and the inside temperature should be within an allowable temperature range.

③ This derating curve is based on inverter current rating when rated motor is connected.

### 6.4.8 Power ON start selection (FUN_58)

In case 'No' is set, the inverter can be operated only if the terminal should be 'On' again after it is 'Off' once. In case 'Yes' is set, the inverter starts to run at the instant the power is supplied to the inverter if FX terminal input is 'On' or RX terminal input is 'On'. If the inverter starts to run while the motor is freely rotating, first, the motor decelerates to a stop and restart.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_58 | Power-on Run | Power on start selection | Yes<br>No | | No |

**⚠ CAUTION**

Particular attention should be directed to this function due to potential hazard as motor starts to run suddenly upon applying AC input power.

### 6.4.9 Restart after fault reset (FUN_59)

In case 'No' is set, the inverter can be operated only if the terminal should be 'On' again after it is 'Off' once. In case 'Yes' is set, the inverter starts to run at the instant the inverter fault is cleared if FX terminal input is 'On' or RX terminal input is 'On'. At the time of the inverter trip, the motor start to coast to a stop because the inverter blocks the IGBT gating signals. If the inverter starts to run while the motor is freely rotating, first, the motor decelerates to a stop and restart. If set CON_49 [Speed search] to bit 1 from previous bit 2, operation begin by speed search function when fault is reset.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_59 | RST Restart | Restart after fault reset | Yes<br>No | | No |

**⚠ CAUTION**

Take caution for this function. When FUN_59 is set, motor runs immediately upon fault is reset.

### 6.4.10 Restart after fault reset

**1) FUN_60 (number of auto restart try)**

**2) FUN_61 (delay time before auto restart)**

This function prevents the permanet stop of the inverter due to the trip. The inverter automatically resets the fault and restarts and continues to run after the fault occurs if the number of automatic restart is set and the inveter operation is possible.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_60 | Retry Number | Number of auto restart try | 0 ~ 10 | | 0 |
| FUN_61 | Retry Delay | Delay time before Auto restart | 0.0 ~ 60.0 | sec | 1.0 |

In case the inverter trip occurs, the inverter restarts by **'The number of automatic restart'** at FUN_60. In case of the inverter trip, the inverter resets the fault automatically and waits for **'Delay time before automatic restart'** at FUN_61 and restarts. The inverter will not restart any more, blocks the IGBT gating signals and issues the trip message if the inverter trip occurs more than **'The number of automatic restart'** at FUN_60. For example, if inverter starts sucessfully by 'automatic restart' (and trip doesn't occur any more), 'the number of automatic restart' doesn't add. If it fails (trip occurs again) 1 is added based on the previous accumulated number. That is, the number is added continuously without the initialization.

The conditions for the initialization of 'the number of automatic restart'.

- The number automatic restart accumulated so far is initailized by turning the inverter power ON/OFF
- If the number of automatic restart reaches to the set value at FUN_60, the automatic restart won't be conducted any more. Then push the reset key in loader forcefully for clearing trip so that the number of automatic restart will be initialized again and be increased from the beginnning.

**CAUTION**

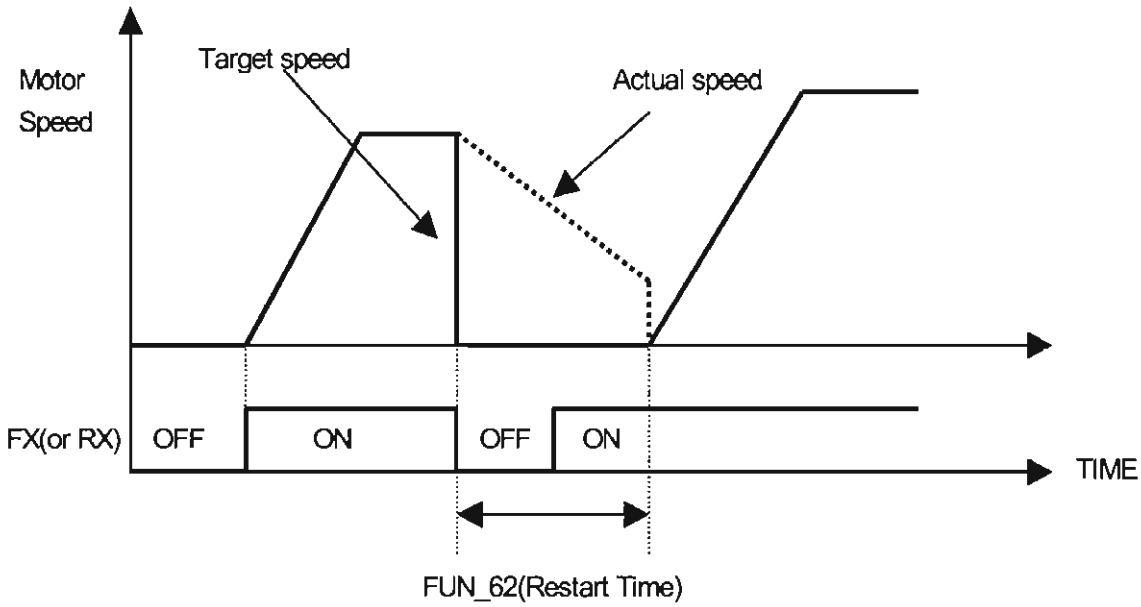
- Particular attention should be directed to this function as the inverter clears the fault automatically and motor suddenly restarts when trip occurs.
- Auto restart function is disabled when the following trips occur.
  - ① BX (Emergency stop)
  - ② Low Voltage
  - ③ Arm Short-U (V, W, DB)
  - ④ Fuse Open
  - ⑤ Ext Trip-B (External trip B)
  - ⑥ InvOver Heat (inverter overheated)
  - ⑦ MotOver Heat (Motor overheated)
  - ⑧ Encoder Err (Encoder error)
  - ⑨ Over Load (Overload trip)
  - ⑩ E-Thermal (Electronic thermal protection)
- If trip does occur in 30 sec after restart, inverter adds the number of restart by one automatically and this cannot exceed setting value.

### 6.4.11 Wait time for restart upon stop

- Only active when FUN_03 is set to 'Free-run' and operating method is 'Terminal'.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_62 | Restart Time | Wait time for Restart upon Stop | 0.00 ~ 10.00 | sec | 0.00 |
| FUN_03 | Stop mode | Stop method | Decel<br>**Free-run** | | Decel |

Even though restart command is input after stopping the operation, inverter does not run until FUN_62 setting time elapses.




### 6.4.12 Overspeed error detection

- Inverter detects error if motor rpm exceeds its limit. User can set the detection level and time of overspeed.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_63 | OverSpdLevel | Overspeed Detection Level | 100.0 ~ 130.0 | % | 120.0 |
| FUN_64 | OverSpd Time | Overspeed Detection Time | 0.00 ~ 2.00 | sec | 0.00 |

- FUN_63 is based on 100% of FUN_04(Max Speed).
- When motor speed exceeds FUN_63 (Overspeed Detection Level) and FUN_64(Overspeed Detection Time) elapses, overspeed error detection is activated.
- If FUN_64 is set to 0.00(sec) and motor rpm exceeds FUN_63, inverter immediately detects overspeed error.

### 6.4.13 Brake opening and closing setting

**1) FUN_65(Brake opening time)**

**2) FUN_66(Brake opening speed)**

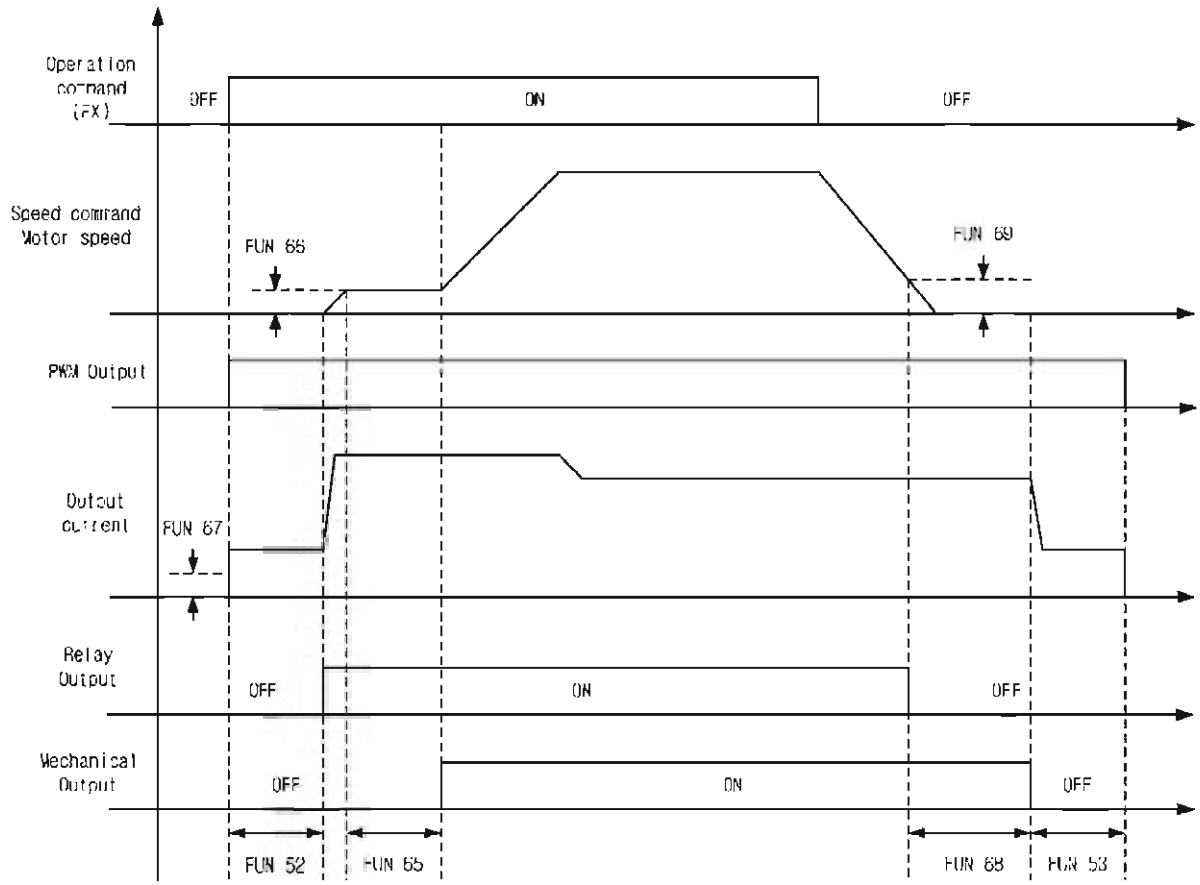
**3) FUN_67(Brake opening current)**

**4) FUN_68(Brake closing time)**

**5) FUN_69(Brake closing speed)**

- It only operates when multi-aux ouput terminal(DIO_41 ~ DIO_43)is set to Brake Output.
  The motor brake is not opened during motor' Auto-tuning, so be sure to open the brake forcedly when you do the rotating type motor's Auto tuning.
- About Brake opening time, Multi-aux output terminal becomes on after passing initial excitation time of motor and it operates with the brake opening speed during set time.
- About Brake opening speed, Multi-aux output terminal becomes on after passing initial excitation time of motor and it operates with the set speed during brake opening time.
- Brake openig current value is set as the percentage of magnetic current of motor. The brake openig signal operates only after ocurring more output current than set value.
- Brake closing time means the set time after multi-aux output terminal is off below the brake closing speed. Set more high brake closing time value than decelerating time between brake closing speed and 0.
- At the brake closing speed, multi-aux ouput teminal becomes off.
- If Backlash phenomenon occurs when the motor is stopping, increase the brake closing set value more and more until the Backlash phenomenon isn't occurs anymore. At the same time, adjust also the brake closing time set value.

| Code | Display | Description | Range | Unit | Default |
|---|---|---|---|---|---|
| FUN_65 | BKOpen Time | Brake opening time | 0.00 ~ 30.00 | sec | 0.00 |
| FUN_66 | BKOpen Spd | Brake opening speed | 0.0 ~ 500.0 | rpm | 0.0 |
| FUN_67 | Release Curr | Brake opening current | 0.0 ~ 150.0 | % | 20.0 |
| FUN_68 | BKClose Time | Brake closing time | 0.00 ~ 30.00 | sec | 0.00 |
| FUN_69 | BKClose Spd | Brake closing speed | 0.0 ~ 500.0 | rpm | 0.0 |

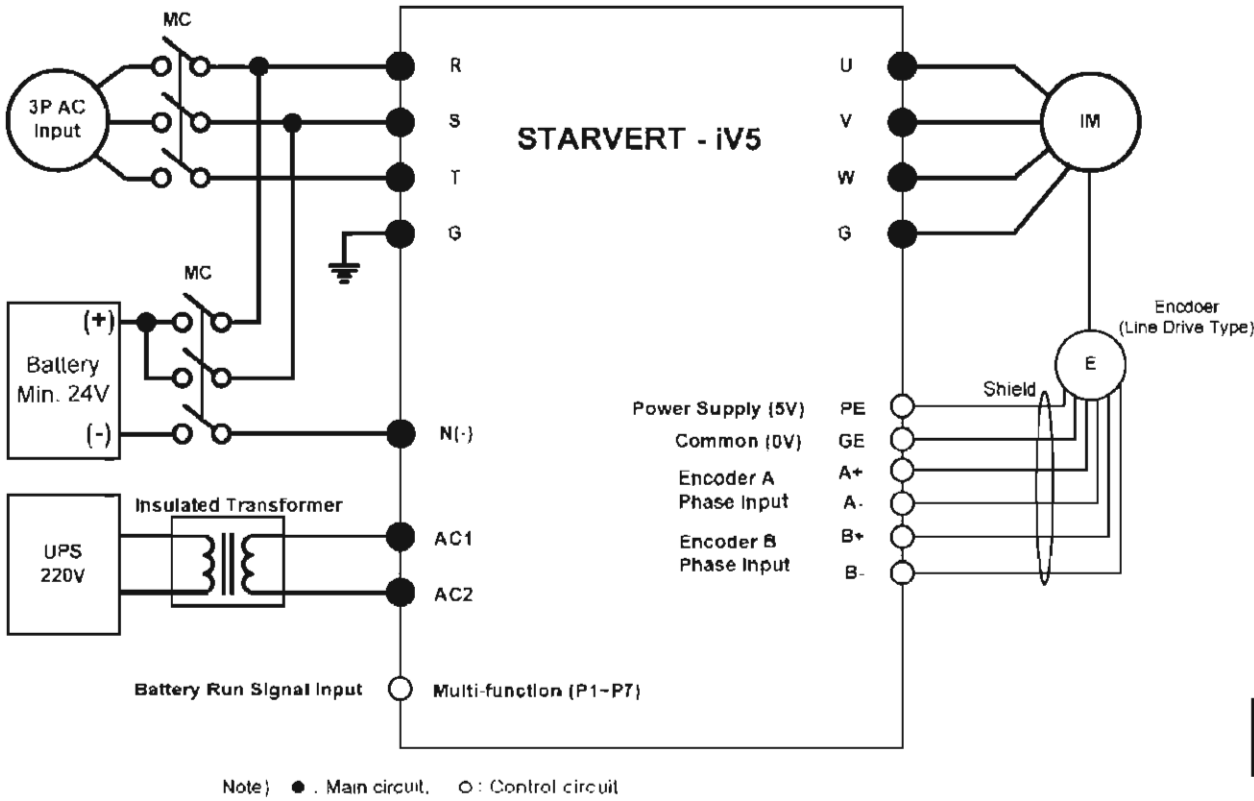

Operation command (FX)
OFF
ON
OFF
Speed command Motor speed
FUN 66
FUN 69
PWM Output
Output current
FUN 67
Relay Output
OFF
ON
OFF
Mechanical Output
OFF
ON
OFF
FUN 52
FUN 65
FUN 68
FUN 53

### 6.4.14 Battery-operated (Battery Run) speed and Input voltage setting

Battery-operated function operates the motor with external battery at elevator application field when main power is not energized by instantaneous power failure etc.. (it is for 5.5 ~ 22 kW-2/4 products.)

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| FUN_70 | Batt. Speed | Battery-operated speed | 2.5 ~ 200.0 | rpm | 50.0 |
| FUN_71 | Batt. Volt | Battery input voltage | 12 ~ PAR_18 | V | 48 |

- FUN-70, 71 code are displayed in case 'Battery Run' of multi-function input DIO_01~07 is turned On.
- FUN_70 sets the operation speed during emergency operation.
- FUN_71 sets the battery voltage used.
- In emergency, battery-operated is activated when the signal is given to terminal which 'Battery Run' function of DIO group is turned On. After it is activated, it is operated with speed set in FUN_70 and level of low voltage trip is changed lower automatically.
- To return to normal mode, release the signal from 'Battery Run' mode of multi-function input turned On.
- Additional wiring for battery-operated mode is as shown below.
  -. Connect the 2 terminals among main circuit input terminal R, S, T to battery positive through MC (Magnetic Contactor).
  -. Connect N (-) terminal of main circuit to battery negative.
  -. Input UPS auxiliary power supply 220V to AC1 and AC2.




Note) ● : Main circuit, ○ : Control circuit

6

- Features of battery-operated function

  -.In battery-operated mode, LED on the right side of the loader for current operation mode and 'BAT' are displayed by turns.

  -.In case multi-function output sets to 'INV Ready', it turns off during battery-operated mode.

  -. After battery power is energized to inverter, inverter will start 2 seconds later after the time for releasing the low voltage trip and raising the internal voltage.

  -.If voltage is falling less than about 53% of FUN_71 set value, it sets down as low voltage trip so it is detected a trip.

  -.To return to main power, main power must be energized after releasing the magnetic contactor and signal from the battery and then low voltage trip is detected.

  -.Operation speed (FUN_71) must be determined according to battery voltage (FUN_70), base speed (PAR_17) and motor rated voltage (PAR_18). Please operate the inverter with low speed by battery capacity.

## 6.5 Control Group (CON_[][])

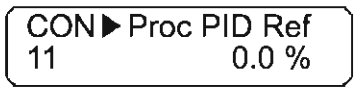
### 6.5.1 Jump code (CON_00)

Jumping directly to any parameter code can be accomplished using CON_00 [Jump code].

Example Jumping to **CON_11**

Press [PROG] key first and set 11 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to CON_11.

If the desired code cannot be accessed or void, it automatically jumps to closest code.




After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

### 6.5.2 Control mode select (CON_01)

In the motor control mode, there are **speed** and **torque** control modes based on the vector control. The speed sensor such as the pulse encoder is required if speed control ('**Speed**') and torque control ('**Torque**') are to be used.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_01 | Control Mode | Control mode selection | Speed<br>Torque | | Speed |

### 6.5.3 Application mode (CON_02)

General vector mode or Elevator mode can be selected in CON_02.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_02 | Application | Application mode setting | General Vect<br>Elevator *1)<br>Synchro*2)<br>WEB Control | | General Vect |

*1) Only displayed with Elevator option board (EL_IO) installed.

*2) Only displayed with Synchonization option board (SYNC_IO) installed.

### 6.5.4 Automatic speed regulator: ASR

**1) CON_05(ASR LPF Time Constant 1)**

**2) CON_08(ASR LPF Time Constant 2)**

One of the two PI gains of ASR can be selected depending on the status of the multi-function terminal input set as the 'ASR Gain Selection'. That is, if the multi-function terminal input is 'Off', 1-numbered gain and LPF time constant is selected. On the contrary, if this input is 'On', 2-numbered gain and LPF time constant are selected.

**(Example)** Programming P4 as ASR PI Gain

| Code | LCD display | Description | Setting range | Unit | Set value |
|---|---|---|---|---|---|
| DIO_04 | P4 define | Multi-function input terminal P4 definition | | | ASR Gain Sel |

The two sets of Lowpass Filter are as follow:

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_05 | ASR LPF1 | ASR LPF time constant 1 | 0 ~ 20000 | ms | 0 |
| CON_08 | ASR LPF2 | ASR LPF time constant 2 | 0 ~ 20000 | ms | 0 |

**3) CON_03 ~ 04(ASR PI Gain 1)**

**4) CON_06 ~ 07(ASR PI Gain 2)**

One of 2 sets of PI gain can be selected by "ASR Gain Sel" in Multi-function input terminal.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_03 | ASR P Gain1 | ASR P Gain 1 | 0.0 ~ 200.0 | % | 50.0 |
| CON_04 | ASR I Gain1 | ASR I Gain 1 | 0 ~ 50000 | ms | 300 |
| CON_06 | ASR P Gain2 | ASR P Gain 2 | 0.0 ~ 200.0 | % | 5.0 |
| CON_07 | ASR I Gain2 | ASR I Gain 2 | 0 ~ 50000 | ms | 3000 |

**5) CON_09 (Ramp time for ASR gain Transfer)**

**6) CON_10 (Motor Speed at the time of ASR Gain Transfer)**

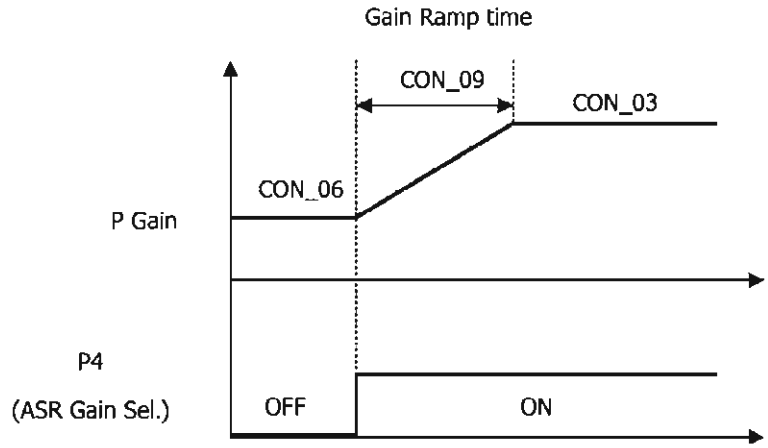
ASR PI controller can be transferred to P controller depending on the status of the multi-function terminal input set as **'ASR P/PI transfer'**.

Example When P6 is set to ASR P/PI transfer:

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| DIO_06 | P6 define | Multi-function input terminal P6 definition | | | ASR P/PI Sel |

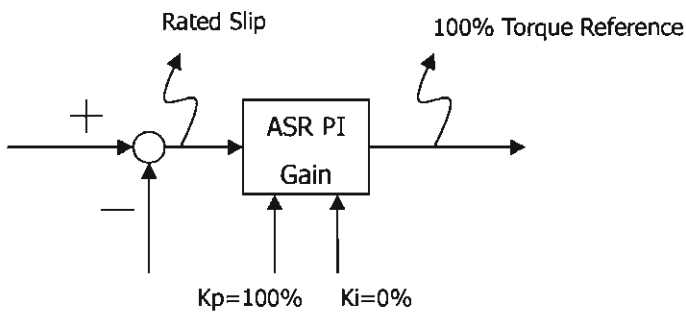
To avoid the shock to the control system due to the rapid change P and I gain in case of ASR gain transfer, if the multi-function terminal input set to **'ASR Gain Sel'** is 'On', the transferred P gain changes gradually for the time set at CON_09. P gain 2 is transferred to P gain 1 at the higher speed than the value set at CON_10. This happens when the multi-function terminal input set to 'ASR Gain Sel' is 'On', not 'Off"

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_09 | ASR Ramp | Ramp time for ASR gain switch-over | 10 ~ 10000 | ms | 1000 |
| CON_10 | ASR TarSpd | Target Speed after ASR gain switch-over | 0.0 ~ 3600.0 | rpm | 0.0 |




- **How to set the P and I gain of the ASR (Automatic Speed Regulator)**

The P gain(%) of ASR becomes equal to the torque reference(%) when the speed difference between the speed command and the real speed fed back to the ASR is identical to the rated slip. The I gain is the time to be taken to accumulate the torque reference from 0 to 100%. That is, The output of ASR becomes equal to the 100% of the torque reference when P gain is set to 100% and the speed difference is equal to the rated slip. Speed response characteristic may be better, but the control system may be unstable when P gain is increased or I gain is decreased. On the contrary, Speed response characteristic may be degraded if P gain is decreased or I gain is increased.



### 6.5.5 Process PID control

Process PID controller is added ouside the speed control loop and a wide variety of process control can be implemented without using the stand-alone PID controller outside the speed control loop or PLC. '**Process PID Enb**' at CON_20 determines whether Process PID controller is enabled or not. '**Process PID Enb**' at CON_20 can be set as follows.

**(Example)** programming CON_20 "Process PID Enable/Disable"

| CON_20 (Proc PID Enb) | RUN/STOP command | |
|---|---|---|
| | ON | OFF |
| Disable | Disable | Disable |
| Enable | **Enable** | Disable |
| Terminal | Depending on terminal definition | Disable |

If '**Process PID Enb**' at CON_20 is set to 'Terminal', Process PID controller is enabled using 'Proc PID Dis', which is the one of the functions of the multi-function terminal input. To avoid the saturation of the process PID controller, process PI controller is enabled only when the multi-function terminal is set to 'Proc PID Dis' and the terminal is 'OFF' and the run command is 'ON'.

| Multi-function input terminal defined as "Proc PID Dis" | | RUN/STOP command | |
|---|---|---|---|
| Input signal | | ON | OFF |
| Defined | ON | Disable | Disable |
| | OFF | **Enable** | Disable |
| Not defined | | Disable | Disable |

The command to Process PID controller uses the digital value (CON_10) set using the keypad or the analog value ('Process PID F/B') which is the one of the multi-function analog output. The setting range of Process PID digital input at CON_11 is from –100 to100% and the setting range of analog input command is from –10 to 10V.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_11 | Proc PID Ref | Process PID Reference Source (Keypad) | -100.0 ~ 100.0 | % | 0.0 |

The definition of P gain and I gain in the Process PID controller is as follows. If P gain is 100% and I gain is 0% and the input error of the Process PID controller (CON_11 + Proc PID Ref - Proc PID F/B) is 100%, the output of Process PID controller is 100%. If I gain is 10% and P gain is 0 and the input error is 100%, it takes the output of the Process PI controller 1 second to be accumulated up to 100%. The higher I gain becomes, the faster the response becomes reducing the accumulated time. Finally, the output of Process PID controller (%) multiplied by the maximum motor speed (FUN_04) is added to the total speed command.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_13 | Proc PID Kp | Process PID P gain | 0.0 ~ 999.9 | % | 0.0 |
| CON_14 | Proc PID Ki | Process PID I gain | 0.0 ~ 100.0 | % | 0.0 |
| CON_15 | Proc PID Kd | Process PID D gain | 0.0 ~ 100.0 | % | 0.0 |

To prevent the Process PID controller from being saturated by the malfunction of the Process PID controller, the output of the Process PID controller can be limited to the positive or negative value, separately from the main speed controller.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_16 | Proc Pos Lmt | Process PID positive limit | -100 ~ 100 | % | 100 |
| CON_17 | Proc Neg Lmt | Process PID negative limit | -100 ~ 100 | % | 100 |

Low pass filter at the output of the Process PID controller can be used. In this case, filter output is multplied by the output gain and fed to the speed command.

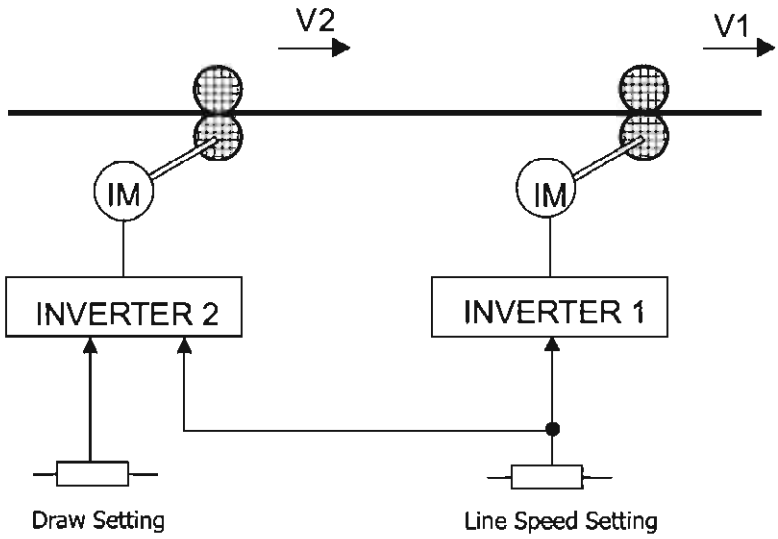
| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_18 | Proc Out LPF | Process PID output LPF time constant | 0 ~ 500 | ms | 0 |
| CON_19 | Proc OutGain | Process PID output gain | -250.0 ~ 250.0 | % | 0.0 |

If the output error of Process PID exists at stopping, it keeps current motor speed during "PID Hold Time" and then free-runs and stops by stopping friction power. If output error is "0", motor is stopped regardless of "PID Hold Time" setting.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_21 | PIDHoldTime | Process PID Hold Time | 0 ~ 10000 | ms | 5000 |

### 6.5.6 Draw control

Draw control is a sort of Open Loop tension control. Draw is the ratio of speed difference between one roll and the other. Tension is generated as in the following equation.




$$D = \frac{V1 - V2}{V2}$$

$$T = E \times S \times D = E \times S \times \frac{V1 - V2}{V2}$$

Where,

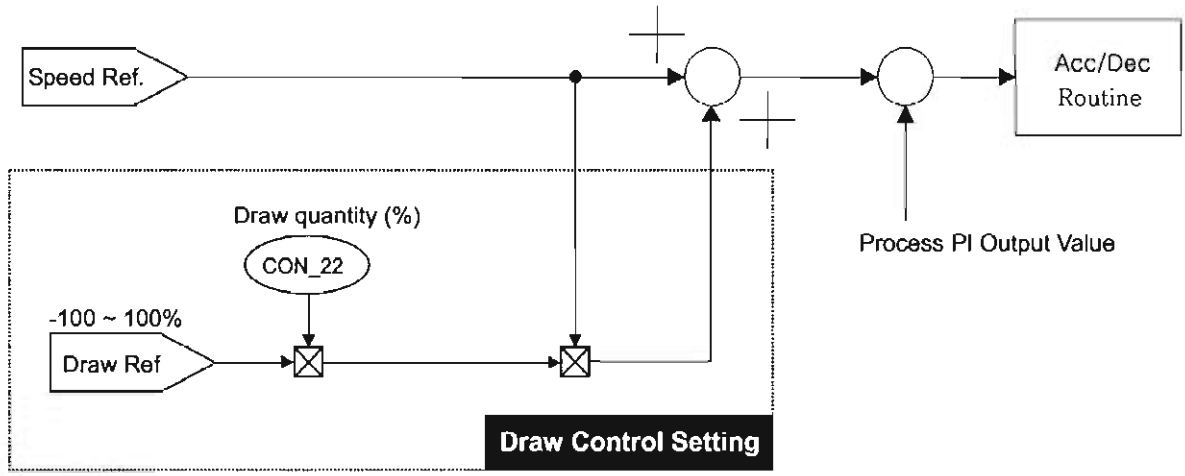
V1, V2: Transfer speed of each roll (m/min)

T: Tension (kg)

E: Elasticity coefficient of processed material (kg/mm2)

S: Sectional area of processed material (mm2)

Draw reference multiplied by draw quantity set at CON_22 is added up to the speed command and the sum acts as the final speed command.



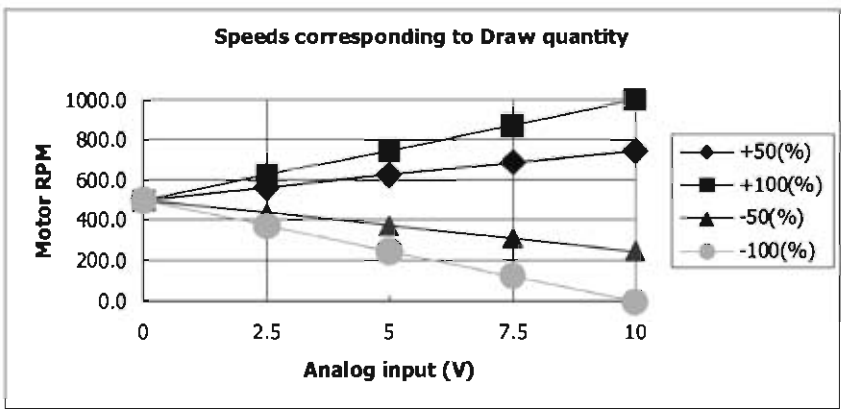

One of the multi-function analog input is set to the draw command ranging from –100% to 100% and the speed command multiplied by Draw quantity is added up to the speed command (Speed Ref) to obtain the final speed command.

Example Programming Ai2 as the Draw Reference

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| AIO_13 | Ai2 Define | Multi-function analog input Ai2 definition | | | Draw Ref |
| FUN_02 | Spd Ref Sel | Speed reference selection | | | Keypad1 |
| FUN_12 | Speed 0 | Multi-speed 0 | 0.0 ~ 3600.0 | rpm | 500.0 |
| CON_22 | Draw % | Draw Quantity | -100.0 ~ 100.0 | % | |

☞ $\text{Run speed} = \text{Spd Ref value} + \text{Spd Ref value} \times \frac{\text{Draw quantity}(\%)}{100(\%)} \times \frac{\text{Anolog input}(V)}{10(V)}$

☞ Sign of analog input operates by absolute value norm.



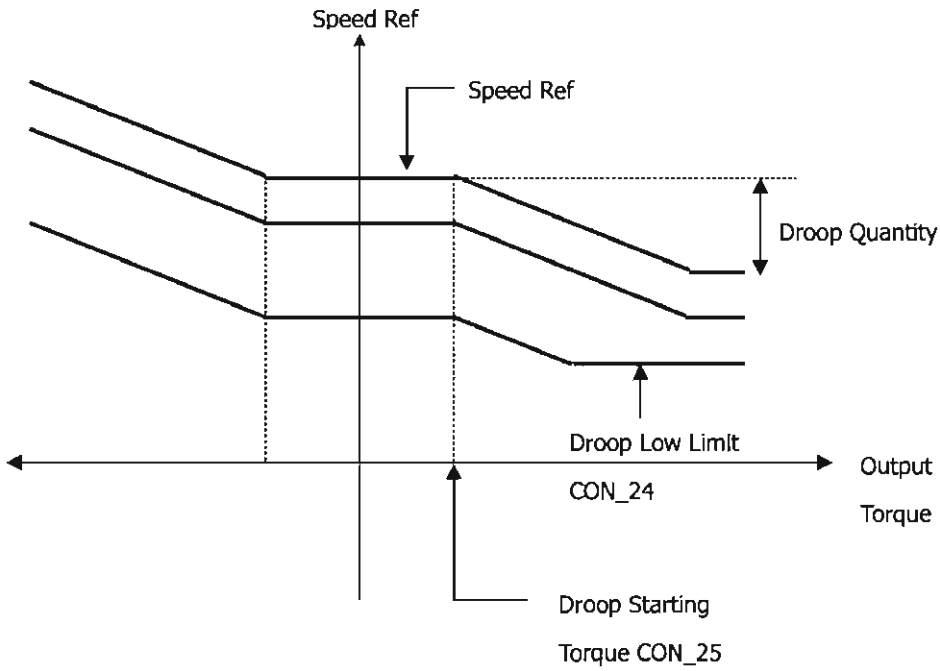
### 6.5.7 Droop control

Droop control uses the drooping characteristic of the speed with respect to the torque reference. This control method is used to prevent the saturation of the speed controller due to the difference between the speed reference and the real speed when the inverter is used for load balancing of the multiple motors and helper roll, which is the auxiliary device of the main roll. As shown in the figure below, the speed command is adjusted properly depending on the torque reference.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_23 | Droop % | Droop Quantity | 0.0 ~ 100.0 | % | 0.0 |
| CON_24 | Droop MinSpd | Low speed limit of Droop control | 0.0 ~ 3600.0 | rpm | 0.0 |
| CON_25 | Droop MinTrq | Starting torque of Droop control % | 0.0 ~ 100.0 | % | 0.0 |

If the torque reference (the output of the speed controller) becomes higher than the set Droop start torque, it reduces the speed command and consequently, decreasing the torque reference. Speed command in the Droop control is as in the following equation.





**Droop** Control Calculation Example

- **When Torque Ref is Positive:**

Droop Ref speed = ( Torque Ref [%] – Droop Starting Torque[%] ) * Droop Quantity[%]

The result value becomes positive. Therefore, final speed ref value decreases and it should be,

(Speed Ref – Droop Ref speed) > Droop low limit speed

Droop Ref speed < (Speed Ref – Droop low limit speed)

Therefore, positive limit is "**Speed Ref** – **Droop Low Limit Speed**".

- **When Torque Ref is Negative:**

Droop Ref speed = –( Torque Ref [%] – Droop Starting Torque[%] ) * Droop Quantity [%]

The result value becomes negative. Therefore, final speed ref value increases and it should be,

(Speed Ref – Droop Ref speed) < Max Motor speed

Droop Ref speed > –(Max Motor speed – Speed Ref)

Therefore, negative limit is "**Max Motor speed** – **Speed Ref**".

### 6.5.8 Torque control

One mode among the speed control mode and torque control mode can be set at CON_01( 'Control Mode'). The default is the speed control mode. Control mode can be selected using the multi-function terminal input set to 'Spd/Trq Sel'. This method has a priority over the one by CON_01.

**(Setting example)** Programming P6 as Torque control

| Code | LCD display | Description | Setting range | Unit | Setting |
|---|---|---|---|---|---|
| DIO_06 | P6 define | Multi-function input terminal P6 definition | | | Spd/Trq sel |
| CON_01 | Control Mode | Control mode setting | Speed<br>Torque | | Torque |

**1) CON_26 (Torque Reference Source Selection)**

**2) CON_27 (Torque Reference Source)**



In the speed control mode, the output of the ASR acts as the torque reference. In the torque control mode, the torque reference is set by the analog input signal defined as 'Trq Ref Src' on the control circuit terminal or by the option board and the polarity is reversed if the direction of the speed command is changed. If the analog input is used as the torque reference, the analog input ranging from –10V to 10V is converted to the percentage of the rated torque (-100~100%) to obtain the torque reference, which can set from –250% to 250% by the settings of Gain and Bias.

CON_27 "Torque Ref" defines torque ref. value when torque source is set to Keypad.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_26 | Trq Ref Src | Torque reference source selection | None/Analog<br>Keypad/Option | | None |
| CON_27 | Torque Ref | Torque Ref (keypad) | -180.0 ~180.0 | % | 0.0 |

**3) CON_32 (Torque Bias Source Select)**

**4) CON_33 (Torque Bias quantity)**

The Torque Bias is the feedforward compensation which is added to the Torque Reference. The source of Torque Bias could be selected by the Keypad (CON_32) as one of Multi Function Analog Input and the Option. The Torque Bias is enabled by MFi programmed as UseTrq Bias. The MFI should be ON for enabling the Torque Bias.

The Analog Input [-10~+10V] is converted to [-100~+100%] and this could be expanded up to [-250~+250%] with gain and bias.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_32 | Trq Bias Src | Torque Bias source selection | None<br>Analog<br>Keypad<br>Option | | None |
| CON_33 | Trq Bias | Torque Bias quantity | -150.0 ~ 150.0 | % | 0.0 |

**5) CON_35 (Torque Balance)**

In the lift use, the load torque balance can be adjusted to obtain a good riding comfort at start-up using the load cell, which is a sort of an weighing devices installed at the bottom of the lift. CON_35 is adjusted to show 50% after the car weight becomes equal to the weight of counter-weight.

The value displayed when pressing [PROG] key on the keypad is the loadcell voltage input to the inverter. Therefore, adjust the percent using [▲(Up)] / [▼(Down)] to make it to be setpoint of actual load compensation.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_35 | Trq Balance | Torque Balance quantity | 0.0 ~ 100.0 | % | 50.0 |

**6) Torque Bias Enable/Disable**

Torque bias is enabled depending on the status of the multi-function terminal input set to 'Torque bias enable'. But, if 'Torque bias enable' is not set and CON_32 is set to 'Keypad', the torque bias command set at CON_32 by the keypad, is fed directly to the torque bias quantity regardless of the status of the terminal. Therefore, In order not to use the torque bias command set at CON_33, CON_32 should be set to 'None' or the multi-function terminal input should be set to 'Torque bias enable' and then the terminal should be left open.

**(Example)** Programming P5 as Torque Bias EnableTorque Bias

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| DIO_05 | P5 define | Multi-function input terminal P5 definition | | | Use Trq Bias |

**7) CON_34(Torque Bias F/F)**

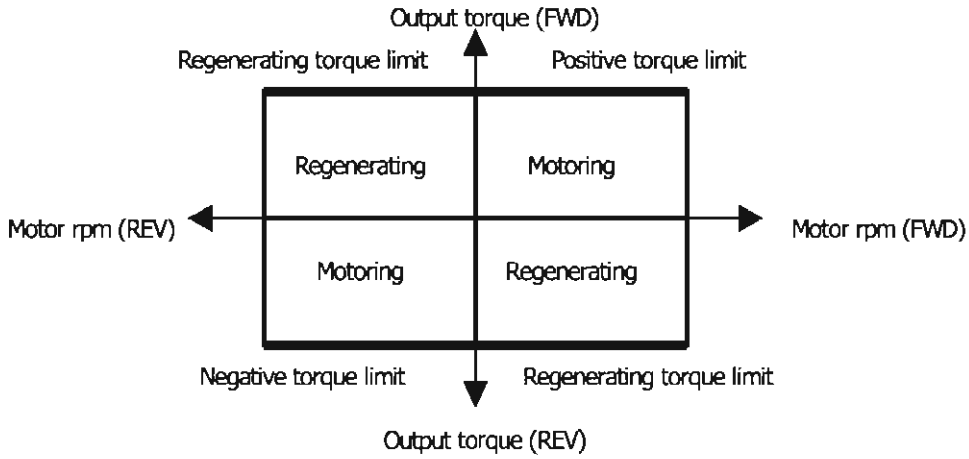
This is the torque bias quantity to compensate for the friction loss, which varies with the rotational direction of the motor and added up to the torque bias quantity.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_34 | Trq Bias FF | Torque compensation for Friction loss | -150.0 ~ 150.0 | % | 0.0 |

### 8) CON_28 ~ 31 (Torque Limit Define, Torque Limit during FWD RUN /REV RUN/Regenerating)

The torque limit can be selected separately depending on the motor control mode such as forward rotation and reverse rotation and regeneration modes. In all modes, the limit values can be set by the function code, the multi-function terminal input and the option board, respectively.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_28 | Trq Lmt Src | Torque Limit Source select | | | Kpd Kpd Kpd |




Torque Limit

Torque Limit value is determined one of the 9 different combinations shown below depending on CON_28 setting.

| CON_28 set value | Positive Torque Limit | Negative Torque Limit | Regenerating Torque Limit |
|---|---|---|---|
| Kpd Kpd Kpd | CON_29 | CON_30 | CON_31 |
| Kpd Kpd Ax | CON_29 | CON_30 | Vx |
| Kpd Ax Kpd | CON_29 | Vx | CON_31 |
| Kpd Ax Ax | CON_29 | Vx | Vx |
| Ax Kpd Kpd | Vx | CON_30 | CON_31 |
| Ax Kpd Ax | Vx | CON_30 | Vx |
| Ax Ax Kpd | Vx | Vx | CON_31 |
| Ax Ax Ax | Vx | Vx | Vx |
| Opt Opt Opt | Positive Torque Limit of Option | Negative Torque Limit of Option | Regenerating Torque Limit of Option |

※ Vx marks the Torque Limit value defined in analog input terminal.

**9) Torque Current reference**

The torque reference is converted to the torque current reference. The torque current reference is generated from the rated current and magnetizing current of the motor. The initial value of the rated current and magnetizing current of the motor can be set by OTIS vector motor parameter that is chosen at PAR_07

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| PAR_07 | Motor Select | Motor capacity selection | 2.2 ~ 375.0 | kW | |
| PAR_22 | Rated-Curr | Motor rated current | 1.0 ~ 750.0 | A | |
| PAR_26 | Flux-Curr | Motor flux current | 0.0 ~ 70% of PAR_22 | A | |

### 6.5.9 Speed search

This is used to restart the motor during coasting without stopping the motor. The setting for using this function is related to setting of FUN_58 and FUN_59. CON_49 are required for this function. The proper values should be set depending on the inertia moment ($GD^2$ ) of the load and the torque of the motor in use.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| CON_49 | Speed Search | Speed search setting | 1111 | | 0100 |
| FUN_58 | Power-on Run | Power on Run selection | Yes<br>No | | No |
| FUN_59 | RST Restart | Restart after fault reset | Yes<br>No | | No |

CON_49 speed search setting is as follows.

| Code | Set value | | | | Description |
|---|---|---|---|---|---|
| | Bit4 | Bit3 | Bit2 | Bit1 | |
| CON_49 | | | | √ | Speed search during Accelerating |
| | | | √ | | Speed search during a Fault Reset restarting |
| | | √ | | | Speed search during Instant Power Failure restarting. |
| | √ | | | | Speed search when FUN_58 Power ON starting is set to "Yes" |

(1) Bit 1
0: The motor is normally accelerated without the speed search operation.
1: The speed search operation is enabled at the time of acceleration.
(Automatic restart and FUN_58[Power-on start enable] included)

(2) Bit 2
0: The motor is normally accelerated without the speed search operation after the trip occurs.
1: The speed search is enabled at the time of restart after the trip occurs.
(Automatic restart and FUN_59[Restart enable after fault reset] included)

(3) Bit 3
0: The motor stops when instantaneous power failure occurs. Run command should be turned ON again to restart the operation.
1: The speed search is enabled at the time of restart after the instantaneous power failure occurs.

(4) Bit 4
0: The motor is normally accelerated only when FUN_58 [Power-on start enable] is set to Yes.
1: The speed search operation is enabled at the time of acceleration when FUN_58 [Power-on start enable] is set to Yes.

## 6.6 User Group (USR_[][])

User group can be generated by collecting the frequently-used function codes, and it also can be created by using the existing function codes for the specific application.

### 6.6.1 Jump code (USR_00)

Jumping directly to any parameter code can be accomplished using USR_00.

**(Example) Jumping to USR_03**

Press [PROG] key first and set 3 using [▲(Up)], [▼(Down)], [SHITF/ESC] and press [ENT] key to jump to USR_03. If the desired code cannot be accessed or void, it automatically jumps to closest code.

After jumping, it is available to jump to other codes using [▲(Up)], [▼(Down)].

### 6.6.2 Macro

**1) USR _01 (Macro Init)**

The initialization of the code type can be defined according to the application the user defines.

| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| USR_01 | Macro Init | Use Macro Definition | User Define<br>E/L | | User Define |

**2) USR_02(User Save)**

This enables the code type and the set value which the user define to be saved into the memory.

**3) USR_03(User Recall)**

This enables the code type and the set value saved by USR_02('User Save') to be recalled from the memory.

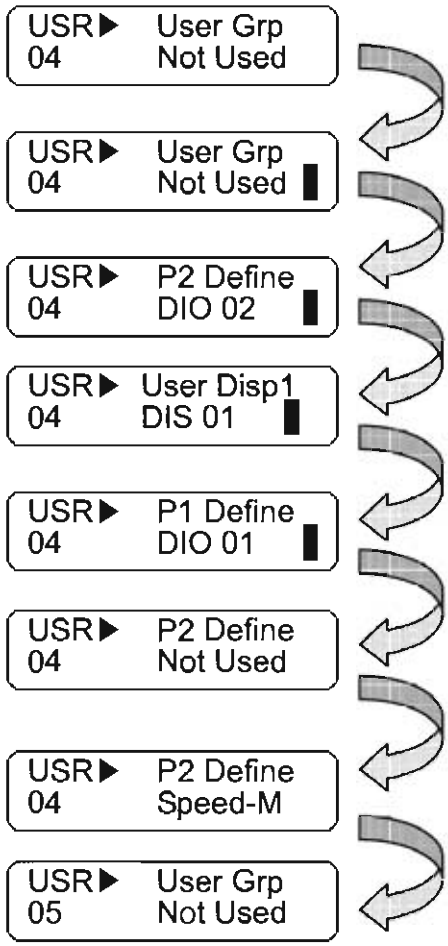
| Code | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| USR_02 | User Save | User data save selection | No<br>Yes | | No |
| USR_03 | User Recall | Recall saved user data | No<br>Yes | | No |

### 6.6.3 User code define (USR_04 ~ 67)

It displays the type and value of the user code when [PROG] key is pressed. The code can be set in the same manner as the codes in the other group can be. If the code is 'User Grp' and its set value is 'Not Used', the code can be changed by pressing the [PROG] key once more.

Total 64 user group data can be programmed and saved. To make the unused data invisible, set it to "Not Used".

**Chaning User group codes**




Press the [PROG] key once.

Pressing the [PROG] key once more and press the [SHIFT/ESC] key to change the group.
( DIS →DIO→PAR→FUN→CON→AIO→2ND→DIS )

Press the [SHIFT/ESC] key once more and the group is changed. ( DIS →DIO )

Pressing [▲(Up)] / [▼(Down)] key navigates the codes in the selected group.

Pressing the [ENT] key changes the code.

Press [PROG] key and change the value using [▲(Up)] / [▼(Down)] and then press [ENT] key to save the value into memory.
Use the [▲(Up)] key to move to other codes in the same group.

## 6.7 2nd Function Group (2nd_[][])

2nd function group is equivalent to the parameter group which includes the data related to the 2nd motor in case single inverter controls 2 motors. One of the multi-function terminal input P1 ~ P7 (DIO_01 ~ DIO_07) should be set to "2nd Func" . The setting ranges and usage of the 2nd motor parameter is basically the same as those of the 1st motor parameters. If the multi-function terminal input enables the 1st motor, the 1st motor parameters become valid. Similiarly, if the multi-function terminal input enables the 2nd motor, the 2nd motor parameters become valid.

### 6.7.1 Jump code (2nd_00)

You can move on to the code you want to check using 2nd_00.

**(Example) If you want to move on to 2nd_02,**

After pressing the [PROG] key, set to02 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] keys and then press the [ENT] key. If the code to jump to is not found, the nearest code number is selected.

```
2nd▶2nd Max Spd
02     1800.0 rpm
```

You can check the other code using [▲(Up)] / [▼(Down)] keys.

### 6.7.2 2nd motor control mode selection (2nd _01)

In the motor control mode, there are **speed** and **torque** control modes based on the vector control. The speed sensor such as the pulse encoder is required if speed control ('**Speed**') and torque control ('**Torque**') is to be used.

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_01 | 2nd Ctl Mode | 2nd motor control mode selection | Speed<br>Torque | | Speed |

### 6.7.3 2nd motor speed setting

#### 1) 2nd_02: The 2nd motor maximum speed

#### 2) 2nd_04: The 2nd digital speed setting

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_02 | 2nd Max Spd | 2nd motor maximum speed | 400.0 ~ 3600.0 | rpm | 1800.0 |
| 2nd_04 | 2nd Spd 0 | 2nd motor multi-step speed 0 | 0.0 ~ 3600.0 | rpm | 0.0 |

### 6.7.4 2nd motor parameters related to acceleration and deceleration

Setting range and factory setting value should be referred to FUN_36 to FUN_41.

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_05 | 2nd Acc S St | 2nd motor S ratio 1 in accel. start | 0.0 ~ 50.0 | % | 0.0 |
| 2nd_06 | 2nd Dec S Ed | 2nd motor S ratio 2 in accel. end | 0.0 ~ 50.0 | % | 0.0 |
| 2nd_07 | 2nd Dec S St | 2nd motor S ratio 1 in decel. start | 0.0 ~ 50.0 | % | 0.0 |
| 2nd_08 | 2nd Dec S Ed | 2nd motor S ratio 2 in decel. end | 0.0 ~ 50.0 | % | 0.0 |
| 2nd_09 | 2nd Acc time | 2nd motor acceleration time | 0.01 ~ 6000.0 | sec | 10.0 |
| 2nd_10 | 2nd Dec time | 2nd motor deceleration time | 0.01 ~ 6000.0 | sec | 10.0 |

### 6.7.5 2nd motor parameters related to the pulse encoder

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_12 | 2nd Enc # | 2nd motor encoder pulse number | 360 ~ 4096 | % | 1024 |
| 2nd_13 | 2nd Enc Dir | 2nd motor encoder direction set | A Phase Lead<br>B Phase Lead | | A Phase Lead |
| 2nd_14 | 2nd Enc Chk | 2nd motor encoder test enable | Yes<br>No | | Yes |
| 2nd_15 | 2nd Enc LPF | 2nd motor encoder LPF time constant | 00 ~ 100 | ms | 1 |

### 6.7.6 2nd motor parameters

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_17 | 2nd BaseSpd | 2nd motor base speed | 300.0 ~ 3600.0 | rpm | 1800.0 |
| 2nd_18 | 2nd R-Volt | 2nd motor rated voltage | 120 ~ 560 | V | |
| 2nd_19 | 2nd Pole # | the number of poles of the 2nd motor | 2 ~ 12 | | 4 |
| 2nd_20 | 2nd Mot Eff. | 2nd Motor Efficiency | 70 ~ 100 | % | 72 |
| 2nd_21 | 2nd R-Slip | 2nd motor rated slip | 10 ~ 250 | rpm | |
| 2nd_23 | 2nd Flx Cur | 2nd motor magnetizing current | 0.0~ Inverter rated current | A | |
| 2nd_24 | 2nd Mot Tr | 2nd motor rotor time constant | 30 ~ 3000 | ms | |
| 2nd_25 | 2nd Mot Ls | 2nd motor stator inductance | 0.00 ~ 500.00 | mH | |
| 2nd_26 | 2nd Mot sLs | 2nd motor leakage coefficient | 0.00 ~ 10.00 | mH | |
| 2nd_27 | 2nd Mot Rs | 2nd motor stator resistance | 0.000 ~ 5.000 | ohm | |

### 6.7.7 2nd motor miscellaneous parameters

| Code No. | LCD display | Function | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|
| 2nd_11 | 2nd Cool Mtd | 2nd motor cooling method | Same as the 1st motor | | Self-cool |
| 2nd_32 | 2nd ETH 1min | 2nd motor 1 min. level for electronic thermal protection | Same as the 1st motor | | 150 |
| 2nd_33 | 2nd ETH Cont | 2nd motor continuous level for electronic thermal protection | Same as the 1st motor | | 100 |

## 6.8 Analog AIO Group (AIO_[][])

### 6.8.1 Jump code (AIO_00)

In AIO_00, jumping directly to any parameter code can be accomplished by entering the desired code number.

**(Example) Moving to AIO_13**

Press [PROG] and set to 5 using [SHIFT/ESC] / [▲(Up)] / [▼(Down)] and press [ENT] key to move to AIO_13. If the desired code cannot be set, the closest code will be displayed.

| | |
|---|---|
| AIO▶ | Ai2 define |
| 13 | Not Used |

Jumping other code is available using [▲(Up)] / [▼(Down)] keys.

### 6.8.2 Multi-function analog input

1) AIO_01 ~ 60 (Multi-function analog input terminal definition, input source, Min. input, Bias, Max. input, Gain, LPF Time constant, criterion of command loss)

3 analog input are assigned for AIO board. Ai3 serves are the Motor NTC/PTC input port and voltage or current signal can be fed into Ai1 and Ai2 by the jumper setting. Analog input on the control circuit terminal can be used as single function among the following 8 functions in the table below (10 functions for Ai3 – including Motor NTC/PTC). Voltage input range is –10 ~ 10V and current input range is 0 ~ 20mA. Any analog input cannot be set as the same function as the other inputs. If 2 analog inputs are set to the same function, last set analog input is changed to "Not Used". When analog input is changed to the other function, previously set value is initialized to 0.

(In the case of EXTN_I/O, 5 analog inputs are possible and Mot NTC/PTC input is possible for Ai5)

| Setting value | Definition | Description |
|---|---|---|
| Speed Ref | Speed Reference | ±10V input is equivalent to ±100% of maximum speed. |
| Proc PID Ref | Process PID Reference | ±10V input is equivalent to ±100% of reference of Process PI controller. |
| Proc PID F/B | Process PID F/B | ±10V input is equivalent to ±100% of reference of Process PI controller. |
| Draw Ref | Draw Control Reference | ±10V input is equivalent to ±100% of reference of Draw controller. |
| Torque Ref | Torque Reference | ±10V input is equivalent to ±100% of rated torque.<br>It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment. |
| Flux Ref | Flux Reference | ±10V input is equivalent to ±100% of rated flux. |
| Torque Bias | Torque Bias | ±10V input is equivalent to ±100% of rated torque.<br>It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment. |
| Torque Limit | Torque Limit | ±10V input is equivalent to ±100% of rated torque.<br>It can be set up to –250 ~ 250% of rated torque by the gain and bias adjustment. |
| Use Mot NTC | Use Motor NTC | Thermal sensor in the motor(NTC) is fed into this terminal. In this case, the motor temperature is displayed and motor overheat alarm and trip signal can be triggered.<br>Caution: This is applied only to LG-OTIS Vector-controlled Motor. |
| Use Mot PTC | Use Motor PTC | Thermal sensor in the motor(PTC) is fed into this terminal. In this case, the motor temperature is displayed and motor overheat alarm and trip signal can be triggered.<br>Thermal sensor is only applied to PT100 products |

Code setting about analog command definition is as follow.

| Code | Display | Definition | | Unit | Function Description |
|---|---|---|---|---|---|
| | | Name | Setting range | | |
| AIO_01 | Ai1 Define | Definition of Multi function analog input Ai1 | Speed Ref<br>Proc PID Ref<br>Proc PID F/B<br>Draw Ref<br>Torque Ref<br>Flux Ref<br>Torque Bias<br>Torque Limit | | It defines the type of Multi function analog input Ai1. |
| AIO_02 | Ai1 Source | Definition of input source of Multi function analog input Ai1 | -10 → 10V<br>10 → -10V<br>0 → 10V<br>10 → 0V<br>0 → 20mA<br>20 → 0mA | | It defines input source of Multi function analog input Ai1. |
| AIO_03 | Ai1 In X1 | Min. input of Multi function analog input Ai1 | 0.00 ~ Ai1 In X2 | % | It sets Min. value of analog input. Without reference to AIO_02 set value, it is based on 0[V](voltage) or 0[mA](current) |
| AIO_04 | Ai1 Out Y1 | Min. input Bias of Multi function analog input Ai1 | -10.00 ~ Ai1 Out Y2 | % | It defines the set value of AIO_01 responding to analog input value of AIO_03. |
| AIO_05 | Ai1 In X2 | Max. input of Multi function analog input Ai1 | 0.00 ~ 100.00 | % | It set Max. input value of analog input value. |
| AIO_06 | Ai1 Out Y2 | Max. input gain of Multi function analog input Ai1 | 0.00 ~ 250.00 | % | It defines the set value of AIO_01 responding to analog input value of AIO_05. |
| AIO_07 | Ai1 In -X1 | -Min. input of Multi function analog input Ai1 | Ai1 In X2 ~ 0.00 | % | It sets -Min. value of analog input. Without reference to AIO_02 set value, it is based on 0[V](voltage) or 0[mA](current) |
| AIO_08 | Ai1 Out -Y1 | -Min. input Bias of Multi function analog input Ai1 | Ai1 Out Y2 ~ 10.00 | % | It defines the set value of AIO_01 responding to analog input value of AIO_07. |
| AIO_09 | Ai1 In -X2 | -Max. input of Multi function analog input Ai1 | -100.00 ~ 0.00 | % | It set -Max. input value of analog input value. |
| AIO_10 | Ai1 Out -Y2 | -Max. input gain of Multi function analog input Ai1 | -250.00 ~ 0.00 | % | It defines the set value of AIO_01 responding to analog input value of AIO_09. |
| AIO_11 | Ai1 LPF | Input LFP time constant of Ai1 | 0 ~ 2000 | ms | It sets LPF time constant about analog input |
| AIO_12 | Ai1 Wbroken | Option for criterion of command loss of Multi function analog input | None<br>Half of x1<br>Below x1 | | It chooses criterion of command loss of analog input Ai1 |

AIO_13 ~ AIO_36(Ai2 ~ Ai3) are the same with the analog input 1(Ai1) above. (In the case of EXTN_I/O, same up to AIO_37 ~ AIO_60(Ai4 ~ Ai5). But in the case of Ai3 and Ai5, there is no current input.

AIO_03 Ai1 In X1 displays the analog input voltage or analog min. input current that inverter recognize as % unit.

It means the percentage(%) of max.input voltage 10[V] or max. input current 20[mA]. For example, if you set AIO_03 Ai1 In X1 as 20[%], the voltage becomes 2[V], the current becomes 4[mA]. And if AIO_04 Ai1 Out Y1 is set as 0[%],

the analog input value that is under voltage 2[V], or current 4[mA] that is fed into analog input terminal will not be recognized.

AIO_04 Ai1 Out Y1 sets the min. level of analog input voltage or current that inverter actually recognizes. For example, if you set AIO_03 Ai1 In X1 as 0[%] and set AIO_04 Ai1 Out Y1 as 20[%] and then, you feed into analog input terminal voltage 2[V] or current 4[mA], when the actual analog input voltage or current that inverter recognizes is 0, inverter recognizes as 20[%].

AIO_15 Ai1 In X2 displays the analog input voltage or analog max. input current that inverter recognize as % unit.

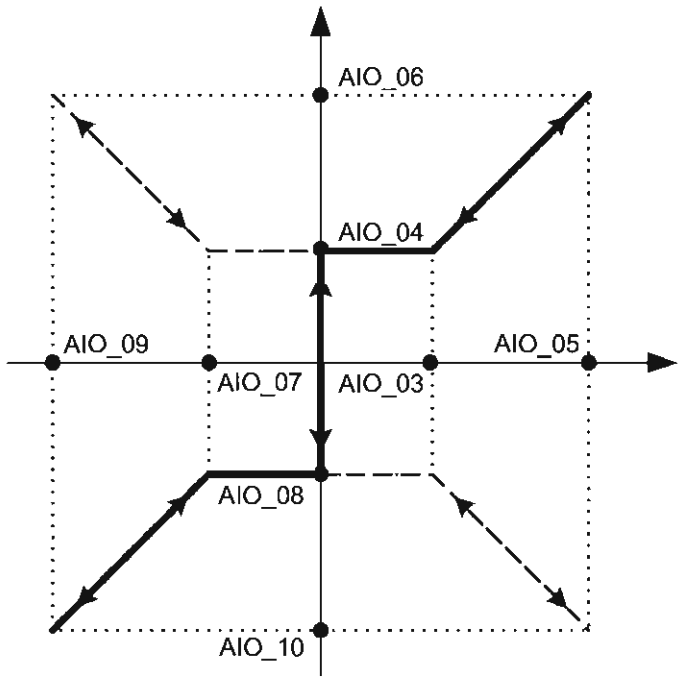
For example, if you set AIO_05 Ai1 In X2 as 50[%], when the actual voltage or current that is fed into analog input terminal is more than 5[V] or 10[mA], inverter recognizes it as max. analog input value.

AIO_06 Ai1 Out Y2 sets the max. level of analog input voltage or current that inverter actually recognizes.

For example, if you set AIO_05 Ai1 In X2 as 100[%] and AIO_06 Ai1 Out Y2 as 50[%], although the voltage 10[V] or the current 20[mA] is actually fed into analog input terminal, inverter recognizes the final analog input value as 50[%].

If you set as above and the rated speed is 1800[rpm], you cannot set more than 900[rpm] although you feed 10[V] into analog input terminal

.




Analog input Mapping diagram

AIO_03 Ai1 In X1 and AIO_05 Ai1 In X2 are for setting the allowed range of voltage of current that is fed into analog input terminal, so generally you can set AIO_03 Ai1 In X1 as 0[%], and AIO_05 Ai1 In X2 as 100[%]. But, the analog input device make happen Chattering around 0[%], you can adjust the set value of AIO_03 Ai1 In X1 up to the level of escaping the Chattering.

When Main Controller recognizes the voltage or current that is fed into analog input terminal, the difference can occur by the detail of I/O devices. . AIO_04 Ai1 Out Y1 and AIO_06 Ai1 Out Y2 are for correcting this error in Main Controller, so they are a kind of Bias and Gain. If the analog input is negative value, you can set AIO_07 ~ AIO_10 as the same as the above.

It is possible for iV5 inverter to input also the upper limit of 2, 4 according to the setting of AIO_02 Ai1 Source, not only the upper limit of 1, 3 as the analog input Mapping diagram. It is also possible to operate along the dotted line according to the setting of AIO_03 ~ AIO_10.

**2) Adjusting Bias: Out Y1 and Gain: Out Y2 by Loader**

- AIO_04 Ai1 Out Y1 adjustment

Connect the voltage source or current source between Ai1 ~ 5G, multi-analog terminals of standard I/O devices.

Feed 0[V] or 0[mA] with the AIO_03 In X1 set as 0% and then follow as below.

| Key | LCD Display | Description |
|---|---|---|
| | AIO▶ Ai1 Out Y1<br>04 0.00 % | Initial Gain (Factory setting) |
| **PROG** | AIO▶Ai1 0.18 %<br>04 Bias 0.00 % | When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting bias on the second line. |
| **▲** | AIO▶Ai1 0.00 %<br>04 Bias 0.18 % | If you want to adjust Bias to be 0.00% at 0V input on the first line, adjust it to be 0.00% using [▲(Up)] key. |
| **ENT** | AIO▶ Ai1 Out Y1<br>04 0.18 % | After setting 0.00% Bias and pressing [ENT] key, it is displayed and the changed value is saved. |

- AIO_06 Ai1 Out Y2 adjustment

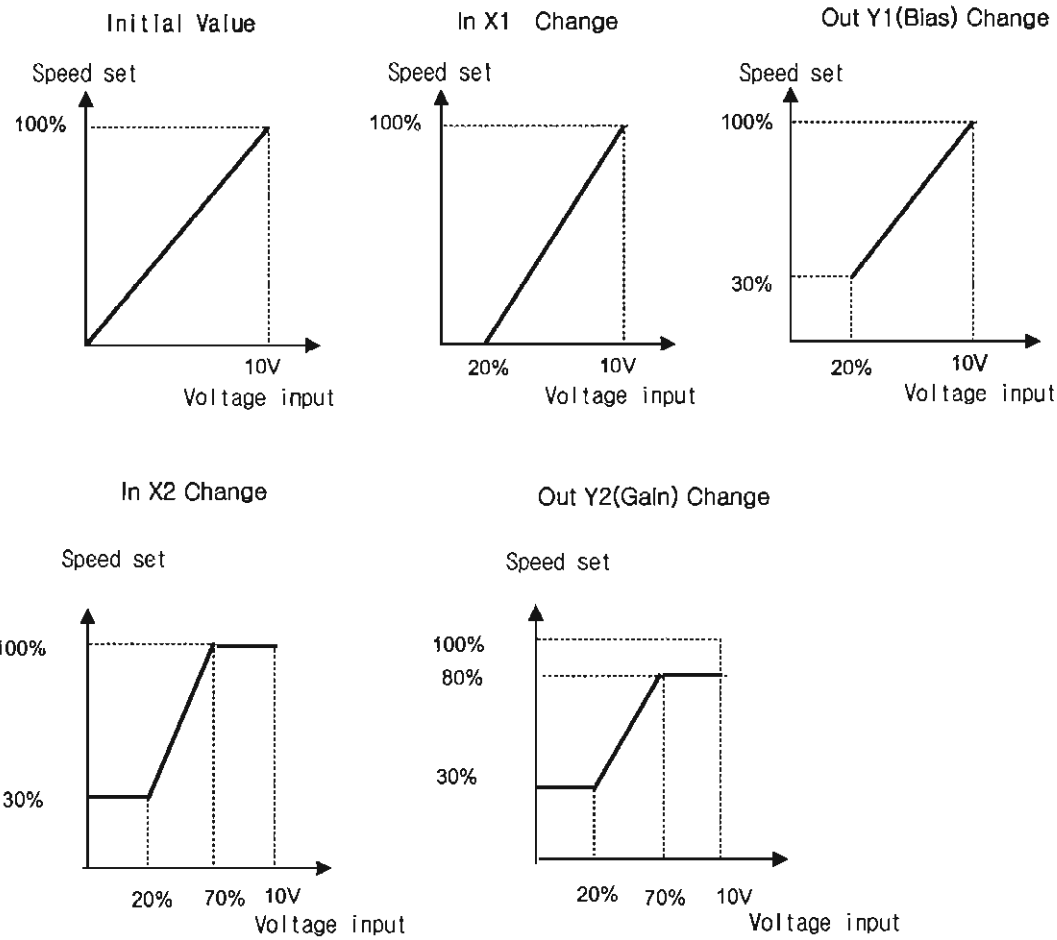
Connect the voltage source or current source between Ai1 ~ 5G, multi-analog terminals of standard I/O devices.

Feed 10[V] or 20[mA] with AIO_05 In X2 set as 100% and then follow as below.

| Key | LCD Display | Description |
|---|---|---|
| | AIO▶ Ai1 Out Y2<br>06 100.00 % | Initial Gain (Factory setting) |
| **PROG** | AIO▶Ai1 98.00 %<br>06 Gain 100.00 % | When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting gain on the second line. |
| **▲** | AIO▶Ai1 100.00 %<br>06 Gain 102.00 % | If you want to adjust Gain to be 100.00% at 10V input on the first line, adjust gain to be 102.00% using [▲(Up)] key. |
| **ENT** | AIO▶ Ai1 Out Y2<br>06 102.00 % | After setting 102.00% Gain and pressing [ENT] key, it is displayed and the changed gain is saved. |

The same procedure is applied to AIO_08 Ai1 –Out Y1 and AIO_10 Ai1 –Out Y2 and also to the other multi-function analog input

For example about multi-function analog input setting , In X1 : 20%, In X2 : 70%, Out Y1 : 30%, Out Y2 : 80% for the 0 ~ 10V input, analog command changes are as follows.




**3) Criterion for command loss of Multi analog input Ai1 (AIO_1)**

**You can choose criterion for command loss of signal that is fed into multi-function analog input.**

| Code | Display | Definition | | Unit | Function description |
|---|---|---|---|---|---|
| | | Name | Setting range | | |
| AIO_12 | Ai1 Wbroken | Criterion for command loss of Multi analog input Ai1 | None | | Do not set analog loss |
| | | | Half of x1 | | If the analog input under the 1/2 of set value of AIO_03 Ai1 In X1 is fed , it means analog loss. |
| | | | Below x1 | | If the analog input under set value of AIO_03 Ai1 In X1 is fed , it means analog loss |

There are same functions for choosing the criterion of command loss of the other multi-function analog input.

**4) Time out for command loss of Multi-function analog input (AIO_73 Time out)**

It means the time for judging the loss time of analog input. If the time that is set at AIO_73 Time Out is passed, it can be considered as analog input loss

| Code | Display | Definition | | Unit | Function description |
|---|---|---|---|---|---|
| | | Name | Setting range | | |
| AIO_73 | Time out | Time for loss of Multi-function analog input | 0.1 ~ 120.0 | sec | It sets the time for judging command loss when the analog input is keeping from the moment of satisfying the condition set at multi-function analog input loss criterion until the set time. |

AIO_73 Time out can be applied 처 AIO_12 Ai1 Wbroken, AIO_24 Ai2 Wbroken, AIO_36 Ai3 Wbroken.

(In the case of I/O(EXTN_I/O, it can also be applied to AIO_48 Ai4 Wbroken, AIO_60 Ai5 Wbroken.)

### 6.8.3 Analog output

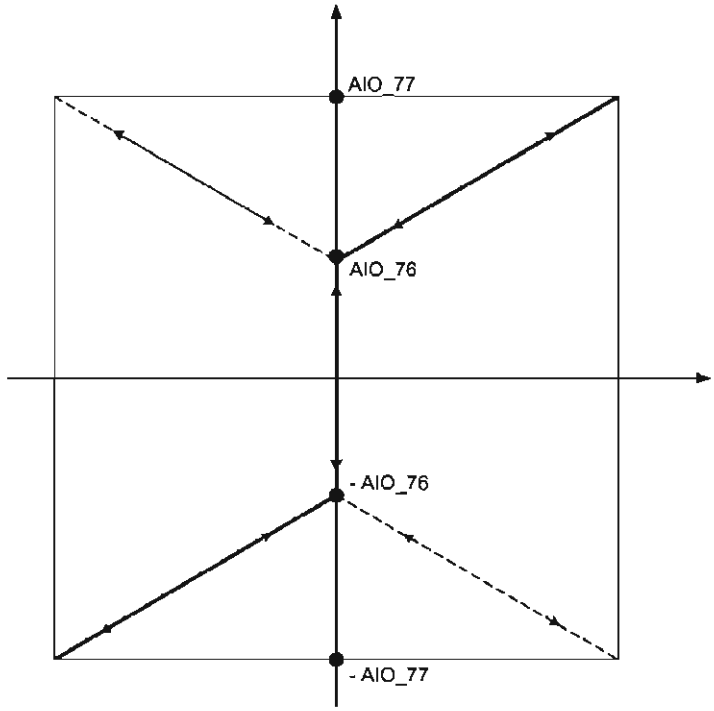
**1) AIO_74 ~ 83(description for multi-function analog output terminal, output source , Bias, Gain, setting absolute value)**

SV-iV5 offers 2 analog outputs and according to the options of user, you can vary the description for using.

The output rage is -10V ~ +10V and the types are as follows.

| Key | Display | Function Definition | | Unit | Function Description |
|---|---|---|---|---|---|
| | | Name | Range | | |
| AIO_74 | AO1 Define | Multi-function analog output A01 definition | | | It describes type of multi-function analog output A01. |
| AIO_75 | AO1 Source | Mullti-function analog output A01 output source definition. | -10 → 10V<br>10 → -10V<br>0 → 10V<br>10 → 0V | | It describes source of multi-function analog output A01. |
| AIO_76 | AO1 Bias | Multi-function analog output A01 Bias | -100.0 ~ AIO_77 | % | . It describes Bias of multi-function analog output A01. |
| AIO_77 | AO1 Gain | Multi-function analog output A01 Gain | 0.0 ~ 500.0 | % | It describes Gain of multi-function analog output A01. |
| AIO_78 | AO1 ABS | Multi-function analog output A01 the absolute value setting | No / Yes | | It is possible to have positive absolute value of analog output A01. |

The other multi-function analog output terminals have same functions. The following pictures is the diagram of Multi-function analog output A01 definition. It can be output as the dotted line according to the setting of A01 Source.




Analog Output Mapping Diagram

### 2) Adjusting Gain and Bias by Keypad

- AIO_76 AO1 Bias setting

  It can be set the Bias value of analog output value. It can occur actual output more than the Bias value.

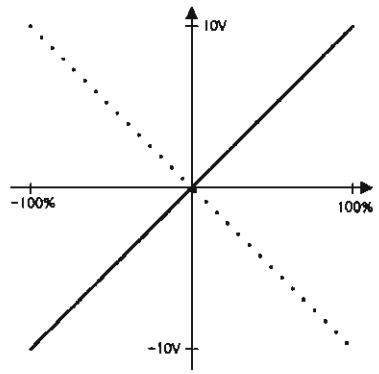
| Key | LCD Display | Description |
|---|---|---|
| | AIO▶ A01 Bias<br>76 0.0 % | Initial Gain (Factory setting) |
| **PROG** | AIO▶Ao1 0.18 %<br>76 Bias 0.00 % | When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting bias on the second line. |
| **▲** | AIO▶Ao1 0.00 %<br>76 Bias 30.0 % | If you want to adjust Bias so that output is occurs when is more than 30% , adjust it to be 30.0% using [▲(Up)] key. |
| **ENT** | I/O▶ A01 Bias<br>76 30.0% | After adjusting Bias and pressing [ENT] key, it is displayed and the changed value is saved. |

- AIO_77 AO1 Gain setting

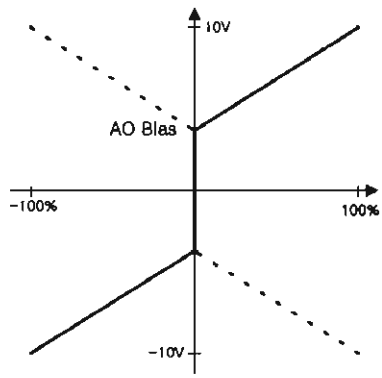
You can set the slope of output so that max. output of analog output can be 10V.

| Key | LCD Display | Description |
|---|---|---|
| | AIO▶ AO1 Gain<br>77 100.0 % | Initial Gain (Factory setting) |
| **PROG** | AIO▶Ao1 30.0 %<br>77 Gain 100.0 % | When pressing the [PROG] key, current output [%] to input value is displayed on the first line and current setting gain on the second line. |
| **▲** | AIO▶Ao1 30.0 %<br>77 Gain 200.0 % | If you want to adjust Gain to be 10V output at more than 200% on the first line, adjust gain to be 200.0% using [▲ (Up)] key. |
| **ENT** | AIO▶ AO1 Gain<br>77 200.00 % | After setting 102.00% Gain and pressing [ENT] key, it is displayed and the changed gain is saved. |

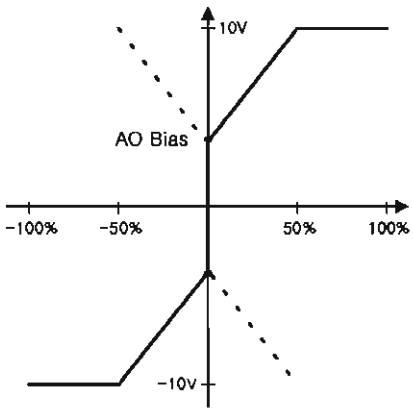
In examples for output setting of multi-function analog output, according to setting of Bias, Gain and the absolute value at -10 ~ 10V input, the output waveform varies as below.



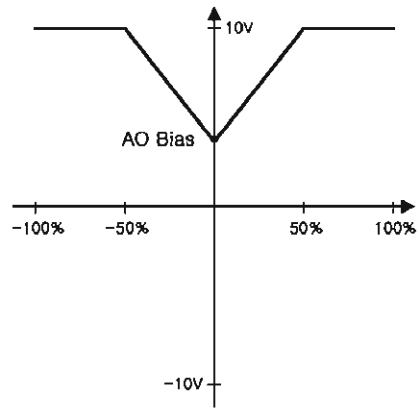

Initail Value (Bias : 0%, Gain : 100%)




Bias 30% setting




Gain 200% setting




Absolute value setting

Multi-function analog output setting types and range are as below

| Setting | Description | Output signal level |
|---|---|---|
| AiX Value | Analog input value | ±10 V: 10V, 20mA |
| PreRamp Ref | Pre Ramp Reference | ±10 V: Max Speed |
| PostRamp Ref | Post ramp reference | ±10 V: Max Speed |
| ASR Inp Ref | ASR Input Reference | ±10 V: Max Speed |
| Motor Speed | Motor Rotating Speed | ±10 V: Max Speed |
| Speed Dev | Speed Deviation | ±10 V: Rated slip * 2 |
| ASR Out | ASR Output | ±10 V: 250% |
| Torque Bias | Torque bias | +6 V: 150% |
| PosTrq Limit | Positive Trq Limit | 10V: 250% |
| NegTrq Limit | Negative Trq Limit | 10V: 250% |
| RegTrq Limit | Regeneration Trq Limit | 10V: 250% |
| Torque Ref | Torque Reference | ±10 V: 250% |
| IqeRef | Torque current ref. | ±10V: 250% of rated torque current |
| Iqe | Torque current | ±10V: 250% of rated torque current |
| Flux Ref | Flux reference | 10V: Flux rating * 2 |
| IdeRef | Flux Current ref. | ±10V: Rated flux current * 2 |
| Ide | Flux Current | ±10V: Rated flux current * 2 |
| ACR_Q Out | ACR output of axis Q | ±10 V: 300/600 |
| ACR_D Out | ACR output of axis D | ±10 V: 300/600 |
| VdeRef | Voltage reference of axis D | ±10 V: 300/600 |
| VqeRef | Voltage reference of axis Q | ±10 V: 300/600 |
| Out Amps RMS | Output current | 10 V: Rated current * 2 |
| Out Volt RMS | Output voltage | ±10 V : 300/600 |
| Power | Output power | ±10 V: Rated output * 2 |
| DC Bus Volt | DC LINK voltage | 10 V: 500/1000V |
| Proc PI Ref | Process PI reference | ±10 V: Rating |
| Proc PI FB | Process PI Feedback | ±10 V: Rating |
| Proc PI Out | Process PI output | ±10 V: Rating |
| Mot NTC Temp | Motor temperature | +10V : 150°C |
| Mot PTC Temp | Motor temperature | +10V : 150°C |
| Inv Temp | Inverter temperature | ±10 V: 100°C |
| Inv i2t | Inverter i2t | 10 V: 150% |

# Chapter 7 - WEB Control Application

## 7.1 Change into WEB control mode

LCD loader display is indicated up to 32 digits in English letters and Arabic numerals, allowing you to directly check a variety of settings on screen.

Shown below are the appearance of LCD loader and the functions of each part.

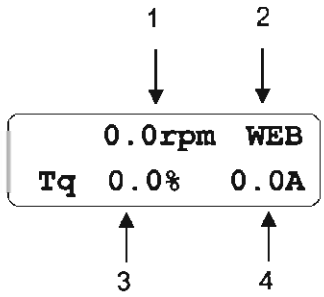
When setting control (CON) group CON_02 (Application) to **"WEB Control"**, LCD loader home screen is changed into web control mode as shown in the following figure. For the function of each key of the loader, please refer to 'Loader' in 4.1, Chapter 4.

### 7.1.1 Method of Changing into Web Control Mode

| | |
|---|---|
| CON▶Application<br>02 General Vect | Move to Application Mode of Control (CON) Group |
| CON▶ Application<br>02 General Vect ■ | Universal Vector Application Mode – Cursor appears (■) |
| CON▶ Application<br>02 WEB Control ■ | Change into WEB control mode using [▲(Up)] key. |
| CON▶ Application<br>02 WEB Control | Set to WEB control mode pressing [ENT] key.. |

## 7.2 Loader Display in WEB Control Mode

### 7.2.1 Home Screen




The status of the screen as above is called "**Home Screen of Display Group**" or "**Home Screen**", and you can return to this home screen by pressing SHIFT/ESC key. Each item on the screen shows the associated information as shown in the table below.

| Item No. | Title | Function |
|---|---|---|
| 1 | Motor Speed | Indicate actual rotating speed of the motor in rpm |
| 2 | Motor Control Mode | SPD : Speed Control Mode<br>TRQ : Torque Control Mode<br>WEB : WEB control mode<br>BX : Indication of Emergency Stop State |
| 3 | Detent Torque | Indicate detent torque occurred against 100% rating output of the motor |
| 4 | Inverter Output Current | Indicate effective value for the inverter's actual output current |

## 7. 3 change of Parameter Group

When selecting WEB control application mode WEB Control Group (WEB) is added following the user group.

| Name of Group | LCD loader (Left upper corner of LCD) | Major Description |
|---|---|---|
| Display Group | DIS | Motor Speed, Motor Control Mode, Detent Torque, Inverter Output Current, User Selection Display, Process PID Output / Ref / Fdb, Current Failure State,<br>User Group Display Setting |
| Digital I/O Group | DIO | Digital Input Parameter, Digital Output Parameter, etc. |
| Parameter Group | PAR | Parameter Initialization, Parameter READ / WRITE / LOCK / PASSWORD, Motor-related Constant, Auto-Tuning, etc. |
| Function Group | FUN | Operation Frequency, Operation Method, Stop Method, Acceleration/Deceleration Time and Pattern,<br>Carrier Frequency, Electronic Thermal Selection, etc. |
| Control Group | CON | Control Mode, ASR PI Gain, Process PID Gain, Draw Control Setting, Droop Control-Related Constant, Torque Control-Related Constant, etc. |
| External Group | EXT | Parameter Setting for Communication Option Mode, etc. |
| Analog I/O Group | AIO | Analog Input- Related Parameter, Analog Output Parameter, etc. |
| WEB group | WEB | Diameter and tension control setting parameters, etc. at the time of Web Control |

- For further details by groups except WEB group, please refer to Function in Chapter 6 of the Main Manual.

## 7.4 Parameter Setting required for Web Control

To conduct WEB control, be sure to set inverter parameters in following sequence. For further details of the function, please refer to the explanation on WEB group function.

### 7.4.1 WEB Control Mode Setting (Compulsory)

In order to use exclusively for web control, be sure to set the setting of CON_02 Application to "WEB Control". Upon setting it to **"WEB CONTROL"**, Web group is displayed. When set to "General Vect" WEB group is not displayed.

```
CON▶ Application
02   WEB Control
```

### 7.4.2 Line Speed Command Setting (Option)

IV5 speed command is available by selecting one out of "Analog, Keypad1, Keypad2, Option, Line SPD Ref, Line SPD Opt" in FUN_02 Spd Ref Sel. In order to use it exclusively for WEB CONTROL, be sure to use either "Line SPD Ref" or "Line SPD Opt" selected. At this time, CON_02 Application should be set to "WEB Control", and then you have to select line speed command in FUN_02 Spd Ref Sel. As the line speed command by analog input one of AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define should be set to "Line Spd Ref". "Line SPD Opt" is the line speed command by communication, and therefore you may set this line speed command in the communication common area 0x050D. For further detail of communication, please refer to the communication common area of communication option borad manual.

① Line Speed Command by Analog Input

```
FUN▶ Spd Ref Sel
02   Line SPD Ref
```

```
AIO▶ Ai1 Define
01   Line SPD Ref
```

② Line Speed Command by Communication

```
FUN▶ Spd Ref Sel
02   Line SPD Opt
```

### 7.4.3 Diameter Hold Function Setting (Option)

If you desire Hold rather than Computation during operation in exclusive using WEB CONTROL, you may use it after setting one of the multi function inputs (DIO_01 ~ DIO_07) to "Dia Hold". In case the multi-function input set is On, the diameter will not be computed any more maintaining the motor speed corresponding with the currently computed diameter only. When the multi-function input is Off, the diameter is computed again.

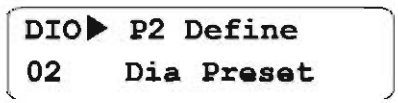
```
DIO▶ P1 Define
01   Dia Hold
```

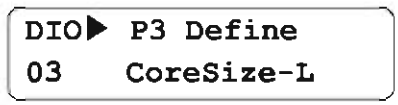
### 7.4.4 Diameter Initialization Function Setting (Compulsory)

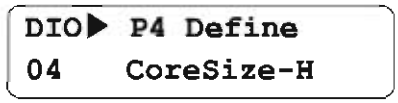
When rewound to full diameter or web is completely unwound from the core, core should be replaced. In this case, you need to inform inverter of the core being replaced. A diameter initialization function can be selected out of multi-function input (DIO_01 ~ DIO_07), analog input, and communication. Diameter initialization source can be selected from WEB_03 DiaPresetSrc.

① Diameter initialization by multi-function input

In the diameter initialization by multi-function input, WEB_03 DiaPresetSrc is set to "Keypad". In this case, one of multi-function inputs (DIO_01 ~ DIO_07) should be set "Dia Preset". Then the rest of multi-function inputs are set to "Core size-L" and "Core size-H", and the preset value selected out of four diameter preset values of WEB-04 ~ WEB-07 by the following combination becomes the initial diameter value in accordance with On/Off of the multi-function input terminal where "Dia Preset" is set. The minimum of the initial diameter value is limited by the WEB_10 Min Diameter.



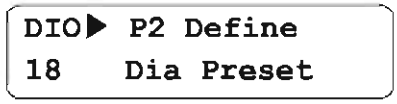




| P3 ON/OFF | P4 ON/OFF | Applicable Preset Core Value |
|---|---|---|
| OFF | OFF | WEB-04 (Diam Preset 1) |
| ON | OFF | WEB-05 (Diam Preset 2) |
| OFF | ON | WEB-06 (Diam Preset 3) |
| ON | ON | WEB-07 (Diam Preset 4) |

② Diameter Initialization by Analog

Diameter initialization by analog is conducted by setting WEB_03 DiaPresetSrc to "Analog". In this case, one of AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define should be set to "Diam Preset". The minimum of the initial diameter value is limited by WEB_10 Min Diameter.



③ Diameter Initialization by Communication

To conduct the diameter initialization by communication, WEB_03 DiaPresetSrc should be set to "Option". In this case, command can be set in communication common area 0x0510. For further detail of communication, please refer to communication common area of communication option borad manual.

```
WEB▶ DiaPresetSrc
03      Option
```

### 7.4.5 Tension Disable Function Setting (Compulsory)

When using it exclusively for WEB CONTROL only, you may conduct tension control using LoadCell or Dancer. In this case, tension control carries out PID control where it is the Tension Disable Function to perform On/Off of the final output of this PID control. With WEB_27 Tension Enb set to "Enable", if Tension Disable is Off, it outputs the final output of PID control while if Tension Disable is On, it interrupts the final output of PID control. When WEB_27 Tension Enb is set to "Disable", Tension Disable Function is not applicable. To conduct the setting Tension Disable Function, you may use it by setting one of the multi-function inputs (DIO_01 ~ DIO_07) to "TensionDisable".

```
DIO▶ P5 define
05 TensionDisable
```

```
WEB▶ Tension Enb
27      Enable
```

WEB_27 should be set to "Enable"

### 7.4.6 Maximum Motor Speed Setting (Compulsory)

This is the setting of maximum rotating speed of the motor in minimum diameter to maintain the maximum line speed in case of exclusively using WEB CONTROL. This can be done by setting WEB_08 MaxMotor SPD. In case of maximum line speed in 100 [m/m], gear ratio in 5:1, and core diameter in 100 [mm], the motor maximum speed can be calculated in the following formula;

$$\text{Max. Motor Speed [rpm]} = \text{Gear Ratio} \times \frac{\text{Max. Line Speed}}{\text{Core Diameter x } \pi} = 5 \times \frac{100\,[m/m]}{0.1\,[m] \times \pi} = 1591.55\,[rpm]$$

```
WEB▶ MaxMotor SPD
08      1591.5 rpm
```

### 7.4.7 Minimum Effective Line Speed Setting (Compulsory)

Minimum effective line speed is the minimum value of the line speed command that can compute the diameter. The line speed command at the time of web control should be larger than the minimum effective line speed. If the line speed command is small than this value, diameter computation is not operated. Setting is done in WEB_09 MinLine SPD.

```
WEB▶ MinLine SPD
09          10.0 %
```

### 7.4.8 Minimum Diameter Setting (Compulsory)

Minimum diameter indicates the diameter of the smallest core in % against the maximum diameter in full diameter. Minimum diameter is used as the minimum limit of diameter computation during operation, and the selected initial core value is restricted by the minimum diameter. Therefore, it should be set equal to or less than the diameter initialized by multi-function input, analog input, or communication. It can be set in WEB_10 Min Diameter.

```
WEB▶ Min Diameter
10          10.0 %
```

### 7.4.9 Diameter Computation Source Setting (Compulsory)

In WEB CONTROL mode, the diameter determines the motor speed keeping a certain line speed. At this time, as the diameter becomes less, motor rotating speed gets faster, while as the diameter become larger, the motor rotating speed gets slower, keeping a certain line speed. Accordingly, the diameter computation source is the function that decides whether to calculate the diameter computation by inverter internal S/W or to calculate the analog output of the diameter sensor attached to the system through the analog input terminal of the inverter.

① Diameter Computation Source when computing the diameter by inverter S/W

Computation of diameter by inverter S/W is to compute the diameter by the built-in S/W. You may set WEB_14 Diameter Src to "Internal".

```
WEB▶ Diameter Src
14      Internal
```

② Diameter Computation Source when computing the diameter using diameter sensor

To compute the diameter using diameter sensor, you need, first, to set WEB_14 Diameter Src to "External", and then one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to "Diameter".

```
WEB▶ Diameter Src
14      External
```

```
AIO▶  Ai1 Define
01      Diameter
```

**Note) When the diameter computation source is set to "External", the diameter initialization function doesn't move.**

### 7.4.10 Rewind/Unwind Function Setting (Compulsory)

Tension control is divided into three (3) method; First, Unwind Function – tension control in such manner as time goes by the diameter of material gets smaller keeping rewinding; Second, tension control of a fixed roll such as Bridle Roll or Nip Roll; Lastly, Wind or Rewind Function – tension control in such manner as time goes by the diameter of material gets larger keeping winding. In case of setting Rewind/Unwind function, please set to "Rewind" when winding the material in WEB_17 Re/Un Wind or when it is Bridle Roll or Nip Roll, while set to "Unwind" when unwinding the material. Motor rotating direction and splicing operation direction is decided depending on the setting of WEB_17 Re/Un Wind.

① When it is Bridle Roll or Nip Roll, or in case of winding the material;

```
WEB▶ Re/Un Wind
17      Rewind
```

② In case of unwinding material

```
WEB▶ Re/Un Wind
17      Unwind
```

### 7.4.11 Overwind/Underwind Function Setting (Compulsory)

In case of Rewinding or Unwinding, there are two kinds of method depending on the location when winding or unwinding the material; First – Overwinding that is winding or unwinding the material from the upper part, Second – Underwinding that is winding or unwinding the material from the lower part. Roll rotating direction and PID output are decided depending on the setting of inverter operation command, WEB_17 Re/Un Wind, and WEB_18 O/U Wind. Selection of Overwind/Underwind function can be set in WEB_18 O/U Wind.

① In case of winding or unwinding the material from the upper part;

```
WEB▶  O/U Wind
18    Overwind
```

② In case of winding or unwinding the material from the lower part;

```
WEB▶  O/U Wind
18   Underwind
```

Following figure and table shows line speed command, PID output command, splicing command direction **following the setting of Rewind/Unwind** function and **Overwind/Underwind** function. For further detail, please refer to the explanation on WEB group.

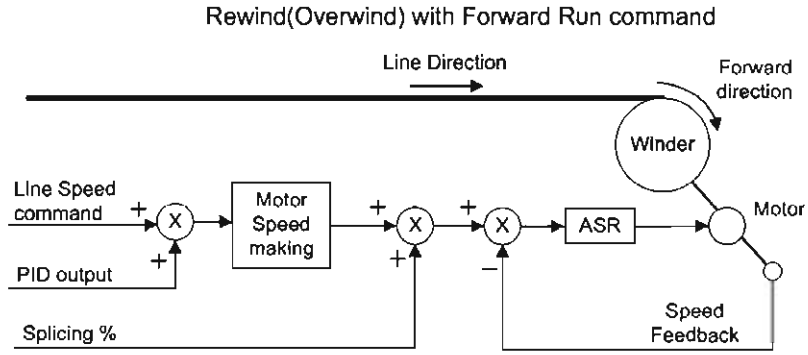



Figure 1. Roll Rotating Direction at the time of Rewind/Overwind Setting, Forward Direction Operation Command

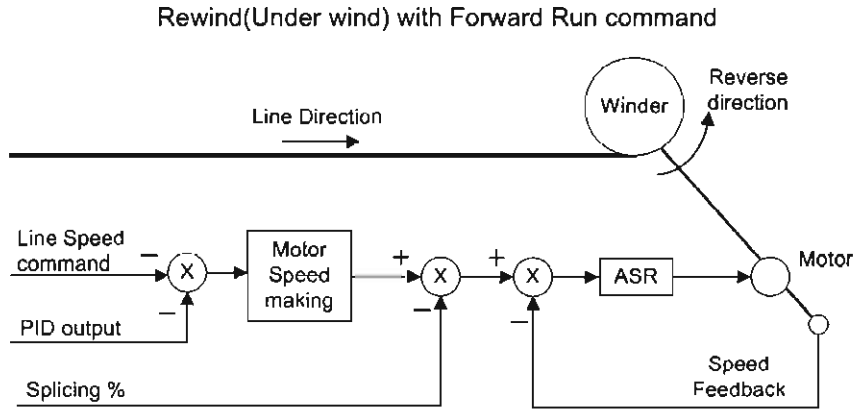



Figure 2. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

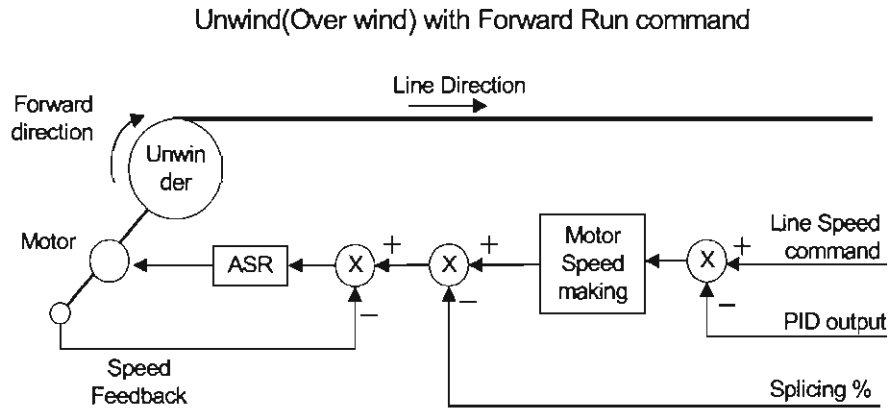



Figure 3. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

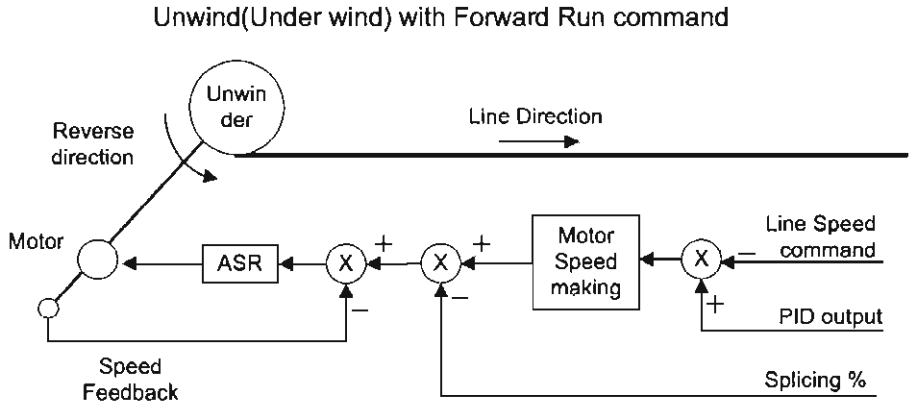



Figure 4. Roll Rotating Direction at the time of Unwind/Overwind Setting, Forward Direction Operation Command

### 7.4.12 tension Reference input Setting (Compulsory)

In case of using loadcell for tension control sensor, tension reference is used for setting the set point of actual tension. In this case, final tension Reference, the output of set block becomes the reference input of PID control. When not using Taper function, Boost function, and Stall function, tension reference input value becomes the reference input of PID control. Tension reference input setting constitute three methods; by keypad, by analog input, and by communication. The sum of the values from these three method is input, that is the sum of WEB_19 Tension input + Analog input + communication. Furthermore, upper/lower limit is restricted within the range of – 100.0 % ~ 100.0 %. At this time, WEB_28 PIDRef Sel should be set to "Taper Out". If dancer is used, it means controlling the position of dancer rather than actual tension. Therefore if WEB_28 PIDRef Sel is set to "Dancer Pos", the value set in tension input reference input is meaningless. If dancer taper function is used where analog output(AIO_74, AIO_79) is set to "Tension Out", its usage is meaningful. For the dancer position, like in the case of tension reference, the sum of WEB_29 Dancer Pos + Analog input + communication is input

① Tension Reference Input Setting by Keypad (In case of using loadcell)

To conduct tension reference input setting by keypad, you may set WEB_19 Tension Input.

```
WEB▶ TensionInput
19          50.0 %
```

② Tension Reference Input Setting by Analog Input (In case of using loadcell)

To conduct tension reference input setting by analog input, you may set one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to "Tension Ref".

```
AIO▶ Ai1 Define
01   Tension Ref
```

③ Tension Reference Input Setting by Communication (In case of using loadcell)

To conduct tension reference input setting by communication, you may use communication common area Address 0x0511. For further detail, please refer to communication common area data.

④ Dancer Position Input Setting by Keypad (In case of using dancer)

To conduct dancer position input setting by Keypad, you may set WEB_28 PIDRef Sel to "Dancer Pos" and then set WEB_29 Dancer Pos.

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

```
WEB▶ Dancer Pos
29        50.0 %
```

⑤ Dancer position input Setting by analog input (In case of using dancer)

To conduct dancer position input setting by analog input, you may set WEB_29 PIDRef Sel to "Dancer Pos", and then set one of Analog Input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to "Dancer Ref".

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

```
AIO▶ Ai1 Define
01   Dancer Ref
```

⑥ Dancer position input Setting by communication (In case of using dancer)

To conduct dancer position input setting by communication, you may set WEB_28 PIDRef Sel to "Dancer Pos" and then use communication common area address 0x0512.. For further detail, please refer to communication common area data.

```
WEB▶ PIDRef Sel
28   Dancer Pos
```

**All the functions related with PID control should be set. The relevant function codes are as follows;**

**-. WEB_30 ProcPID Kp1**

**-. WEB_32 ProcPID Ki1**

**-. WEB_42 PIDOGainRe or WEB_43 PIDOGainUn**

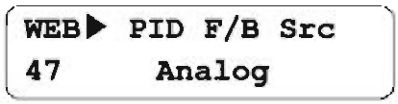
**-. Please operate it with the rest function codes related with PID control set to default. If any change required, please refer to the explanation on WEB group function.**

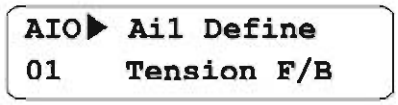
### 7.4.13 PID Control Feedback Source Setting (Compulsory)

Setting the amount of feedback at the time of PID control can be conducted in two ways; First, PID feedback by analog input, Second, PID feedback by communication. You can set it in WEB_47 PID F/B Src.

① PID Feedback Setting by Analog Input

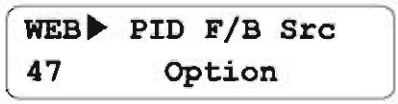
To conduct PID feedback setting by analog input, first, you may set WEB_47 PID F/B Src to "Analog", and then set one of Analog input AIO_01 Ai1 Define, AIO_13 Ai2 Define, and AIO_25 Ai3 Define to "Tension F/B".




② PID Feedback Setting by Communication

To conduct PID feedback setting by communication, first, you may set WEB_47 PID F/B Src to "Option" and then use communication common area Address 0x0513. For further detail, please refer to communication common area data. In case of using PID Feedback for communication, however, its feedback should be done with communication cycle not exceeding 10 [msec]. If communication cycle exceeds 10 [msec], PID feedback setting by communication should not be conducted.




## 7.5 Display Group (DIS_[][])

### 7.5.1 DIS_01 ~ 03 (User Selection Display 1, 2, and 3)

In the User Selection Display 1, 2, and 3, one of the followings selected can be indicated. Factory default is "PreRamp Ref" for DIS_01, "DC Bus Volt" for DIS_03, and "Terminal In" for DIS_03. If "WEB Control" is selected for CON_02 Application of Control(CON) Group, it displays the following. Please be noted that the displays at the time of WEB CONTROL are summarized only in this data.

| Function Code | Loader Display | Name of Function | Unit | Explanation on Function |
|---|---|---|---|---|
| DIS_01 ~ DIS_03 | Diameter | Diameter | % | Displays diameter in % value |
| | Line SPD CMD | Line Speed Command | % | Display line speed command in % value |
| | Reel SPD | Roll Speed | % | Display roll rotating speed in % value |

### 7.5.2 Digital Input/Output Group (DIO_[][])

**1) DIO_01 ~ DIO_07 (Definition of multi-function input P1~7)**

In case of selecting CON_02 Application of Control(CON) Group as "WEB Control", you may select the following function in addition. For further detail, please refer to the explanation on WEB group function.

<table>
<tr><th>Function Code</th><th>Loader Display</th><th>Name of Function</th><th>Unit</th></tr>
<tr><td rowspan="15">DIO_01<br>~<br>DIO_07</td><td>Dia Hold</td><td>Diameter Computation Hold Command</td><td>Select when desiring to hole the diameter computation</td></tr>
<tr><td>Dia Preset</td><td>Diameter Initialization Command</td><td>Select when initializing diameter</td></tr>
<tr><td>CoreSize-L</td><td>Core Select 1 Function</td><td rowspan="2">Select one of WEB_04 ~ WEB_07 by On/Off of the multi-function input terminal at the time of diameter initialization by keypad
<table>
<tr><th>CoreSize-L</th><th>CoreSize-H</th><th>Preset Core Applied</th></tr>
<tr><td>OFF</td><td>OFF</td><td>WEB_04 Diam Preset 1</td></tr>
<tr><td>ON</td><td>OFF</td><td>WEB_05 Diam Preset 2</td></tr>
<tr><td>OFF</td><td>ON</td><td>WEB_06 Diam Preset 3</td></tr>
<tr><td>ON</td><td>ON</td><td>WEB_07 Diam Preset 4</td></tr>
</table></td></tr>
<tr><td>CoreSize-H</td><td>Core Select 2 Function</td></tr>
<tr><td>Tension Disable</td><td>Tension Control Prohibition</td><td>Prohibit the process PID controller output when the set multi-function input terminal is On.</td></tr>
<tr><td>PI Gain Sel</td><td>Process PID Controller PI Gain Transfer</td><td>PI Gain of process PID is transferred from 1 to 2 when the set multi-function input terminal is On. (WEB_30) (WEB_31) (WEB_32) (WEB_33)</td></tr>
<tr><td>PID ITerm Clear</td><td>Accumulated portion of I controller of Process PID controller is initialized</td><td>Accumulated portion of I controller of Process PID controller is initialized when the set multi-function input terminal is On.</td></tr>
<tr><td>Taper Disable</td><td>Taper Function Prohibition</td><td>Stops the taper function when the multi-function input terminal set during operation mode by taper function is On</td></tr>
<tr><td>Stall Enable</td><td>Stall Function Setting</td><td>Stall function operates when the set multi-function input terminal is On.</td></tr>
<tr><td>Boost Enable</td><td>Boost Function Setting</td><td>Boost function operates when the set multi-function input terminal is On</td></tr>
<tr><td>Quick Stop</td><td>Emergency Stop Function Setting</td><td>Inverter stops after the lapse of the time set in WEB_54 when the multi-function input terminal set to stop the inverter operation at emergency is On</td></tr>
<tr><td>Jog Web</td><td>Jog operation function Setting</td><td>Jog operates when the set multi-function input terminal is On. FUN_01 should be set to "Terminal 1", and Jog operates even if Fx terminal is not On</td></tr>
<tr><td>Under Wind</td><td>Under wind function Setting</td><td>Although the value in WEB_18 is set to "Overwind", it operates Under wind if the set multi-function input terminal is On.</td></tr>
<tr><td>Unwinder</td><td>Unwinder function Setting</td><td>Although the value in WEB_17 set to "Rewind", it operates Unwinder if the set multi-function input terminal is On.</td></tr>
</table>

(1) Diameter Hold function :

If the multi-function input terminal set to "Dia Hold" is On, it stops diameter computation and maintains the diameter value. At this time, the diameter hold function operates if one of the following conditions is satisfied.

① Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to "Dia Hold" is On

② Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to "Quick Stop" is On

③ Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to "Quick Stop" is On, and the multi-function input terminal set to "TensionDisable" is On, or WEB_27 Tension Enb is "Disable"

④ Condition of diameter initialization (Except function code initialization) is not satisfied, and the multi-function input terminal set to "Jog Web" is On.

⑤ Condition of diameter initialization (Except function code initialization) is not satisfied, and WEB Break occurs.

(2) Diameter Preset Function :

The multi-function input terminal set to "Dia Preset becomes On, when the diameter preset function operates if one of the following conditions is satisfied.

① The multi-function input terminal set to "Dia Preset becomes On, and the line speed command is less than the set value of WEB_09 MinLine SPD

② The multi-function input terminal set to "Dia Preset becomes On, and the multi-function input terminal set to "TensionDisable" is On.

When initializing the function code in PAR_01 Para. Init, the initialized value of diameter in this case is always initialized with the set value of WEB_04 Diam Preset 1.

(3) Jog operation function :

Jog operates if one of the following conditions is met where the multi-function input terminal set to "Jog Web" becomes On.

① FUN_01 Run/Stop Src is set to "Terminal 1", and only the multi-function input terminal set to "Jog Web" is On

② FUN_01 Run/Stop Src is set to "Keypad", and only the multi-function input terminal set to "Jog Web" is On after the FWD button is pressed in keypad

③ **When FUN_01 Run/Stop Src is set to "Terminal 1", the inverter doesn't operate if both Fx signal and Jog Web signal are On.**

**2) Multi-function Auxiliary Output Terminal Definition (DIO_41 AX1 Define ~ I/O_43 OC1 Define)**

When CON_02 Application of Control (CON) Group is selected as "WEB Control", you can select the following function in addition. For further detail, please refer to WEB group function explanation.

| Function Code | Loader Display | Definition of Function | | Unit | Explanation of Function |
|---|---|---|---|---|---|
| | | Name | Setting Range | | |
| DIO_41 | AX1 Define | Web Break Detection | WEB Break | % | Detects and outputs the short of Web |
| | | Up to Speed Detection | Up to Spd | % | Detects and outputs the deviation between line speed command and actual line speed |
| | | False Core Detection | False Core | % | Outputs if the diameter is less than the set value in WEB_16 |

The rest of the multi-function output terminal has the same function. In the standard input/output board, however, AX1 and AX2 are relay output while OC1 is open collector output.

### 7.5.3 Analog Input/Output Group (AIO_[][])

**If you select** "WEB Control" at CON_02 Application, you can select following functions more. The function description is simple, so refer to WEB Group function description for more details.

| Function Code | Loader Display | Definition of Function | | Unit | Explanation of Function |
|---|---|---|---|---|---|
| | | Name | Setting Range | | |
| AIO_01 | Ai1 Define | Line Speed Command | Line SPD Ref | % | The set value of WEB_08 MaxMotor SPD is maximum line speed command 0 ~ 100% where the input is 0 ~ 10V. In case of ±10V input, it recognizes 0 ~ 10V. |
| | | Tension Command | Tension Ref | % | I t means the maximum tension command value is ±10 where the input |
| | | Dancer Position Command | Dancer Ref | % | It means dancer command value is ±100% where the input is ±10V |
| | | Taper Command | Taper Ref | % | It means taper command value is ±100% where the input is ±10V |
| | | Tension Feedback | Tension F/B | % | It means the amount of tension feedback is ±100% where the input is ±10V |
| | | Diameter Input | Diameter | % | In case of using the diameter sensor, it means the diameter is ±100% where the input is ±10V |
| | | Diameter Initialization | Diam Preset | % | In case of using diameter initialization by analog input, it means the diameter is ±100% where the input is ±10V |
| AIO_74 | AO1 Define | Final Line Speed Command | Line Speed | % | Outputs the final line speed command that is the sum of line speed command and PID controller output |
| | | Final Tension Command | Tension Out | % | Outputs the final tension command after computing Taper, Boost, and Stall |
| | | Diameter | Diameter | % | Outputs the current diameter |

### 7.5.4 Function Group (FUN_[][])

If CON_02 Application of Control (CON) Group is selected as "WEB Control", you may select the following function in addition. For further detail, please refer to the explanation on WEB group function.

| Function Code | Loader Display | Definition of Function | | Unit | Explanation of Function |
|---|---|---|---|---|---|
| | | Name | Setting Range | | |
| FUN_02 | Spd Ref Sel | Speed Setting Method | Line SPD Ref | | It is set when conducting line speed command with analog input at the time of Web control. |
| | | | Line SPD Opt | | It is set when conducting line speed command with communication at the time of Web control.. |

**Note) In case of setting FUN_02 Spd Ref Sel to the other value than "Line SPD Ref" or "Line SPD Opt", you cannot make exact Web control. Therefore, please set "Line SPD Ref" or "Line SPD Opt" without fail.**

### 7.5.5 Control Group (CON_[][])

CON_02 Application allows you the setting of general vector control mode and WEB control mode. **In case of conducting Web control, please set "WEB Control" without fail. Only when setting "WEB Control", you can confirm all the function and Web group necessary for WEB control in the keypad.**

| FunctionCode | Loader Display | Definition of Function | | Unit | Explanation of Function |
|---|---|---|---|---|---|
| | | Name | Setting Range | | |
| CON_02 | Application | application control | General Vect | | It is set when using the general vector function. |
| | | | WEB Control | | It is set when using Web control function. |

## 7.6 Function Code of WEB Application Group (WEB_[][])

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| WEB_00 | - | Selection of Function Code | Jump Code | 1 ~ 59 | | | Yes | |
| WEB_01 | 7C01 | Diameter Size Display | Diameter | 5.0 ~ 100.0 | % | 10.0 | No | 7-18 |
| WEB_02 | 7C02 | Selected Initial Diameter | Current Core (Display Only) | 0 (Diam Preset 1)<br>1 (Diam Preset 2)<br>2 (Diam Preset 3)<br>3 (Diam Preset 4)<br>4 (Analog)<br>5 (Option) | | 0 (Diam Preset 1) | No | 7-18 |
| WEB_03 | 7C03 | Setting of the Type of Diameter Initiallzation | DiaPresetSrc | 0 (Keypad)<br>1 (Analog)<br>2 (Option) | | 0 (Keypad) | No | 7-18 |
| WEB_04 | 7C04 | 1st Diameter Initial Value | Diam Preset 1 | WEB_10 ~ 100.0 | % | 10.0 | No | 7-20 |
| WEB_05 | 7C05 | 2nd Diameter Initial Value | Diam Preset 2 | WEB_10 ~ 100.0 | % | 15.0 | No | 7-20 |
| WEB_06 | 7C06 | 3rd Diameter Initial Value | Diam Preset 3 | WEB_10 ~ 100.0 | % | 20.0 | No | 7-20 |
| WEB_07 | 7C07 | 4th Diameter Initial Value | Diam Preset 4 | WEB_10 ~ 100.0 | % | 25.0 | No | 7-20 |
| WEB_08 | 7C08 | Motor Maximum Rotating Speed with Min. Diameter | MaxMotor SPD | 75.0 ~ 3600.0 | rpm | 300.0 | Yes | 7-21 |
| WEB_09 | 7C09 | Minimum Effective Line Speed | MinLine SPD | 0.0 ~ 100.0 | % | 5.0 | No | 7-21 |
| WEB_10 | 7C0A | Minimum Diameter | Min Diameter | 5.0 ~ 100.0 | % | 10.0 | No | 7-22 |
| WEB_11 | 7C0B | Selection of Acceleration/Deceleration Time Setting in case of WEB Control | AccDecWeb | 0 (No) / 1 (Yes) | | 1 (Yes) | No | 7-22 |
| WEB_12 | 7C0C | Acceleration Time in case of WEB Control | Acc TimeWeb | 0.00 ~ 6000.0 | sec | 0.50 | Yes | 7-22 |
| WEB_13 | 7C0D | deceleration Time in case of WEB Control | Dec TimeWeb | 0.00 ~ 6000.0 | sec | 0.50 | Yes | 7-22 |
| WEB_14 | 7C0E | Setting of the Type of Diameter Computation | Diameter Src | 0 (Internal)<br>1 (Exernal) | | 0 (Internal) | No | 7-22 |
| WEB_15 | 7C0F | Time Constant of Diameter Computation LPF | Diameter LPF | 0.01 ~ 300.00 | sec | 5.00 | Yes | 7-23 |
| WEB_16 | 7C10 | False Core Value | False Core | 0.0 ~ 50.0 | % | 5.0 | Yes | 7-23 |
| WEB_17 | 7C11 | Rewind/Unwind Setting | Re/Un Wind | 0 (Rewind)<br>1 (Unwind) | | 0 (Rewind) | No | 7-23 |
| WEB_18 | 7C12 | Overwind /Underwind Setting | O/U Wind | 0 (Overwind)<br>1 (Underwind) | | 0 (Overwind) | No | 7-24 |
| WEB_19 | 7C13 | Tension Reference Input Setting | TensionInput | -100.0 ~ 100.0 | % | 0.0 | Yes | 7-26 |
| WEB_20 | 7C14 | Taper Type Setting | Taper Type | 0 (None)<br>1 (Hyperbolic)<br>2 (Linear) | | 0 (None) | No | 7-26 |
| WEB_21 | 7C15 | Taper Input Value Setting | Taper Input | -100.0 ~ 100.0 | % | 0.0 | No | 7-26 |
| WEB_22 | 7C16 | Boost Type Setting | Boost Type | 0 (Proportional)<br>1 (Fixed) | | 0 (Proportional) | No | 7-27 |
| WEB_23 | 7C17 | Boost Input Value Setting | Boost Input | 0.0 ~ 50.0 | % | 0.0 | No | 7-27 |
| WEB_24 | 7C18 | Stall Type Setting | Stall Type | 0 (Proportional)<br>1 (Fixed) | | 0 (Proportional) | No | 7-28 |
| WEB_25 | 7C19 | Stall Input Value Setting | Stall Input | 0.0 ~ 50.0 | % | 0.0 | No | 7-28 |
| WEB_26 | 7C1A | Ramp Time Setting of Tension Reference Input Value | Tension Ramp | 0.00 ~ 600.00 | sec | 5.00 | Yes | 7-29 |
| WEB_27 | 7C1B | Tension Control Enable Setting | Tension Enb | 0 (Disable)<br>1 (Enable) | | 1 (Enable) | No | 7-30 |
| WEB_28 | 7C1C | PID Reference Type Setting | PIDRef Sel | 0 (Dancer Pos)<br>1 (Taper Out) | | 1 (Taper Out) | No | 7-30 |
| WEB_29 | 7C1D | Dancer Reference position Setting | Dancer Pos | -100.0 ~ 100.0 | % | 0.0 | Yes | 7-31 |
| WEB_30 | 7C1E | Process PID P1 Gain Setting | ProcPID Kp1 | 0.0 ~ 999.9 | % | 10.0 | Yes | 7-31 |
| WEB_31 | 7C1F | Process PID P2 Gain Setting | ProcPID Kp2 | 0.0 ~ 999.9 | % | 0.0 | Yes | 7-31 |
| WEB_32 | 7C20 | Process PID I1 Gain Setting | ProcPID Ki1 | 0.0 ~ 100.0 | sec | 5.0 | Yes | 7-31 |
| WEB_33 | 7C21 | Process PID I2 Gain Setting | ProcPID Ki2 | 0.0 ~ 100.0 | sec | 0.0 | Yes | 7-31 |

| Code No. | Comm. Addr | Code Name | LCD DISPLAY | Setting Data | | | Adjustment During Run | PAGE |
|---|---|---|---|---|---|---|---|---|
| | | | | Range | Unit | Default | | |
| WEB_34 | 7C22 | PID Gain Ramp Time Setting | PIDGain RAMP | 0.1 ~ 100.0 | sec | 1.0 | Yes | 7-32 |
| WEB_35 | 7C23 | Process PID P Gain Profiler Type Setting | P Profiler | 0 (Linear)<br>1 (Square)<br>2 (Cubed)<br>3 (Quadratic) | | 0 (Linear) | No | 7-32 |
| WEB_36 | 7C24 | Process PID P Gain Profiler Gain Setting | P Apt Gain | -1.00 ~ 10.00 | | 0.00 | No | 7-32 |
| WEB_37 | 7C25 | Process PID D Gain Setting | ProcPID Kd | 0.0 ~ 100.0 | % | 0.0 | Yes | 7-33 |
| WEB_38 | 7C26 | Process PID D Gain LPF | ProcKd LPF | 0.0 ~ 100.0 | sec | 2.0 | Yes | 7-33 |
| WEB_39 | 7C27 | Process PID Positive Limit | Proc Pos Lmt | -100.0 ~ 100.0 | % | 100.0 | Yes | 7-33 |
| WEB_40 | 7C28 | Process PID Negative Limit | Proc Neg Lmt | -100.0 ~ 100.0 | % | -100.0 | Yes | 7-33 |
| WEB_41 | 7C29 | Process PID Output LPF Time Constant | PID Out LPF | 0.00 ~ 100.00 | sec | 1.00 | Yes | 7-34 |
| WEB_42 | 7C2A | Rewind-Use Process PID Output Gain | PIDOGainRe | -250.0 ~ 250.0 | % | 0.0 | Yes | 7-34 |
| WEB_43 | 7C2B | Unwind-Use Process PID Output Gain | PIDOGainUn | -250.0 ~ 250.0 | % | 0.0 | Yes | 7-34 |
| WEB_44 | 7C2C | PID Controller Type Setting | PID Type | 0 (Proportional)<br>1 (Fixed) | | 0 (Proportional) | No | 7-34 |
| WEB_45 | 7C2D | Minimum PID Controller Output Setting | Min FPID | 0.0 ~ 50.0 | % | 10.0 | No | 7-34 |
| WEB_46 | 7C2E | Time of Maintenance of PID Controller After Break | PIDHoldTime | 0.0 ~ 100.0 | sec | 5.0 | Yes | 7-36 |
| WEB_47 | 7C2F | Process PID Feedback Type Setting | PID F/B Src | 0 (Analog)<br>1 (Option) | | 0 (Analog) | No | 7-36 |
| WEB_48 | 7C30 | WEB Break Detection Function Setting | WB Enable | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 7-38 |
| WEB_49 | 7C31 | Setting of Time Delayed until Web Break Detection after Inverter Operation | INV WB Delay | 0.1 ~ 600.0 | sec | 1.0 | Yes | 7-38 |
| WEB_50 | 7C32 | Time Delayed for WEB Break Detection | WB Delay | 0.1 ~ 600.0 | sec | 1.0 | Yes | 7-38 |
| WEB_51 | 7C33 | WEB Break Detection Level | WB Level | 0.0 ~ 100.0 | % | 0.0 | Yes | 7-38 |
| WEB_52 | 7C34 | Up to Speed Judgment Setting | UTS Enable | 0 (No) / 1 (Yes) | | 0 (No) | Yes | 7-39 |
| WEB_53 | 7C35 | Up to Speed Level | UTS Level | 0.0 ~ 100.0 | % | 0.0 | Yes | 7-39 |
| WEB_54 | 7C36 | Quick Stop time Setting | Quick Stop | 0.0 ~ 100.0 | sec | 1.0 | Yes | 7-39 |
| WEB_55 | 7C37 | Jog Speed Setting | JogSpd Web | 0.0 ~ 100.0 | % | 10.0 | Yes | 7-40 |
| WEB_56 | 7C38 | Jog Acceleration/Deceleration Time Setting Select | JogTime Sel | 0 (No) / 1 (Yes) | | 1 (Yes) | No | 7-40 |
| WEB_57 | 7C39 | Jog Acceleration Time Setting | JogAcc Time | 0.00 ~ 6000.0 | sec | 5.00 | Yes | 7-40 |
| WEB_58 | 7C3A | Jog deceleration time Setting | JogDec Time | 0.00 ~ 6000.0 | sec | 5.00 | Yes | 7-40 |
| WEB_59 | 7C3B | Splicing Level Setting | Splice Level | 0.0 ~ 100.0 | % | 0.0 | Yes | 7-40 |

## 7.7 WEB Group Function

### 7.7.1 Jump code(WEB_00)

You may directly jump into the code desired using WEB_00.

**(Example) If you want to move to WEB_03;**

Press [PROG] key, and then press [SHIFT/ESC] / [▲UP] / [▼DOWN] keys to set 3.

Then you may move to the following mode by pressing [ENT] key.

```
WEB▶ DiaPresetSrc
03       Keypad
```

After jump movement, you can move to the other code using [▲UP] / [▼DOWN] key.

### 7.7.2 Diameter Display

**1) WEB_01 Diameter : Diameter Size Display**

It indicates in % value the sizes of the diameter computed by the inverter internal S/W or the diameter of the analog output of the diameter sensor built in the inverter stem input through the analog input terminal.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_01 | Diameter | Diameter Size Display | 5.0 ~ 100.0 | % | 10.0 |

**2) WEB_02 Current Core : Display of Initial Diameter Selected**

It indicates the initial diameter selected. It is displayed as follow depending on the setting of WEB_03 DiaPresetSrc. First, when set to "Keypad", depending on the combination of multi-function input (DIO_01 ~ DIO_07) it displays "Diam Preset 1 ~ Diam Preset 4". Second, when set to "Analog", it displays "Analog". Lastly, when set to "Option", it displays "Option".

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_02 | Current Core | Displays initial diameter selected (Display Only) | Diam Preset 1<br>Diam Preset 2<br>Diam Preset 3<br>Diam Preset 4<br>Analog<br>Option | | Diam Preset 1 |

### 7.7.3 Diameter Initialization

**1) WEB_03 DiaPreset Src : Diameter Initialization Type Setting**

The core will be replaced when winding out the material in case of rewinding or when unwinding out the material. In this case, it requires informing the inverter of the core being replaced when winding or unwinding the material again, and then initializing the computed diameter. Core initialization method constitutes the methods by multi-

function input terminal, by analog input terminal , and by communication.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_03 | DiaPresetSrc | Diameter Initialization Type Setting | Keypad<br>Analog<br>Option | | Keypad |

① Initialization of Core by Multi-function Input Terminal

-. Initialization of Core by Multi-function Input Terminal requires setting WEB_03 to "Keypad" first.

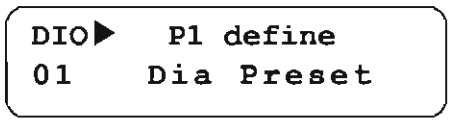
-. Select one of multi-function input terminals (DIO_01 ~ DIO_07), and set it to "Dia Preset".

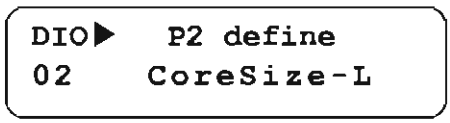
-. Select two of multi-function input terminals (DIO_01 ~ DIO_07), and set them to "CoreSize-L" and "CoreSize-H".

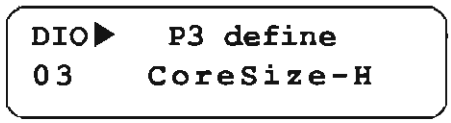
-. Core can be initialized according to On/Off of multi-function input terminal set to "Dia Preset". The core value initialized becomes, however, one of the initial values set in WEB_04 ~ WEB_07 according to On/Off of the multi-function input terminal set to "CoreSize-L" and "CoreSize-H".

-. In case of using the core in one kind only, you don't need to set "CoreSize-L" and "CoreSize-H". In this case, only WEB_04 Diam Preset 1 is applied to the core.

**Example)** The initial diameter value when DIO_01, DIO_02, and DIO_03 are set to "Dia Preset", "CoreSize-L", and "CoreSize-H" respectively.




| P2 ON/OFF | P3 ON/OFF | Preset Core Value Applied |
|---|---|---|
| OFF | OFF | WEB_04 Diam Preset 1 |
| ON | OFF | WEB_05 Diam Preset 2 |
| OFF | ON | WEB_06 Diam Preset 3 |
| ON | ON | WEB_07 Diam Preset 4 |

② Initialization of Core by Analog Input Terminal

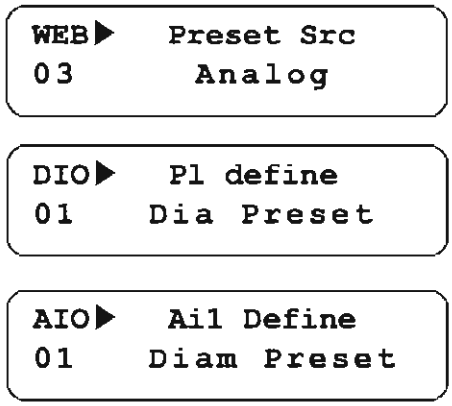
-. Initialization of Core by Analog Input Terminal requires setting of WEB_03 to "Analog" first.

-. Select one of multi-function input terminals (DIO_01 ~ DIO_07) and then set it to "Dia Preset".

-. Select one of analog input terminal definitions (AIO_01, AIO_13, AIO_25), and then set it to "Diam Preset".

-. You may initialize the diameter according to On/Off of multi-function input terminal set to "Dia Preset". The diameter value initialized, however, becomes the value of analog input terminal set, and it is restricted to WEB_10 Mln Diameter.

**Example)** Setting DIO_01 and AIO_01 to "Dia Preset" and "Diam Preset" respectively




③ Initialization of Core by Communication

-. Initialization of Core by Communication requires setting of WEB_03 to "Option" first.

-.Select one of multi-function input terminals (DIO_01 ~ DIO_07), and then set it to "Dia Preset".

-.You may initialize the diameter according to On/Off of multi-function input terminal set to "Dia Preset". The diameter value initialized becomes the value of communication set, and is restricted to WEB_10 Min Diameter.

**2) WEB_04 Diam Preset 1 : 1st diameter initial value**

**3) WEB_05 Diam Preset 2 : 2nd diameter initial value**

**4) WEB_06 Diam Preset 3 : 3rd diameter initial value**

**5) WEB_07 Diam Preset 4 : 4th diameter initial value**

The diameter initialization in tension control (Diam Preset) means empty core at the time of winder operation, while full core at the time of Unwinder operation. In case of initialize the core with multi-function input terminal, it is set with one of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 according to the WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 set to "CoreSize-L"and "CoreSize-H". In case all the defined multi-function input terminals are Off or are not set with the multi-function input, the initial value of diameter is set to "Diam Preset 1". If applying to bridle roll or nip roll instead of general winder and unwidner, you may set all the initial values to 100.0 %. In the core initialization using analog and communication, any initial value of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4 is not applied. The reference of the set value is the diameter initial value expressed in [%] at the time of full diameter.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_04 | Diam Preset 1 | 1st Core initial value | WEB_10 ~ 100.0 | % | 10.0 |
| WEB_05 | Diam Preset 2 | 2nd Core initial value | WEB_10 ~ 100.0 | % | 15.0 |
| WEB_06 | Diam Preset 3 | 3rd Core initial value | WEB_10 ~ 100.0 | % | 20.0 |
| WEB_07 | Diam Preset 4 | 4th Core initial value | WEB_10 ~ 100.0 | % | 25.0 |

The condition of diameter initialization is as follow.

③ Multi-function input terminal set to "Dia Preset" is On and the line speed command is less than the set value of WEB_09 MinLine SPD

④ Multi-function input terminal set to "Dia Preset" is On and the multi-function input terminal set to "TensionDisable" is On

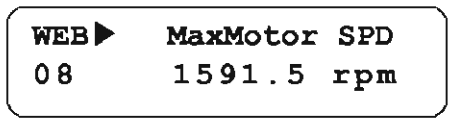
⑤ In case of initializing the function code in PAR_01 Para. Init. In this case, however, the diameter initialization value is always initialized with the set value of WEB_04 Diam Preset 1.

### 7.7.4 Speed setting when doing WEB controlling

**1) WEB_08 MaxMotor SPD : Motor Maximum Rotating Speed in case of Minimum Diameter**

This function indicates the motor maximum rotating speed in case of the minimum diameter with the maximum line speed command given. Accordingly, to maintain the exact line speed, it requires setting the exact motor rotating speed in WEB_08 MaxMotor SPD. Setting can be conducted as follow. Assuming maximum line speed in 100[m/m], gear ratio in 5:1, and core diameter in 100[mm], the maximum motor speed set value becomes 1591.5[rpm].

$$\text{Max. motor speed [rpm]} = \text{Gear Ratio} \times \frac{\text{Max. Line Speed}}{\text{Core Diameter x } \pi} = 5 \times \frac{100\,[m/m]}{0.1\,[m] \times \pi} = 1591.55\,[rpm]$$




| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_08 | MaxMotor SPD | Motor Maximum Rotating Speed in case of Minimum Diameter | 75.0 ~ 3600.0 | rpm | 300.0 |

**Note) After the installation of the system, be sure to check the motor rotating speed using the gauge when the maximum line speed command is given by the empty core.**

**2) WEB_09 MinLine SPD : Minimum Effective Line Speed**

This function is the function related with diameter computation and diameter initialization. The set value is the minimum value of the line speed command that can compute the diameter, that is expressed in [%] in proportion of maximum line speed (100[%]). At the time of winder operation, the line speed command should be larger than the set value to compute the diameter. If the line speed command is smaller than the set value, the diameter

computation is not conducted. If the line speed command is smaller than the set value, and the multi-function input terminal set to "Dia Preset" is On, the diameter can be initialized. The reference of the set value is the [%] of maximum line speed.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_09 | MinLine SPD | Minimum Effective Line Speed | 0.0 ~ 100.0 | % | 5.0 |

**3) WEB_10 Min Diameter : Minimum Diameter**

It indicates the diameter of the smallest core [%], which is used as the minimum limit of diameter computation at the time of Taper computation, P Gain Profiler computation, and Unwinder operation, the minimum limit in diameter computation at the time of Unwinder operation, and the minimum limit in the diameter initialization using analog communication, diameter initialization using communication, diameter computation using diameter sensor. In the inverter S/W, if the set value of WEB_10 Min Diameter is larger than the set value of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4, it is limited to the set value of WEB_10 Min Diameter. Therefore, the set value of WEB_10 Min Diameter should be set to the set value equal to or less than that of WEB_04 Diam Preset 1 ~ WEB_07 Diam Preset 4. If applying Bridle Roll or Nip Roll other than general winder and unwinder, the set value of WEB_10 Min Diameter should be set as 100[%].

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_10 | Min Diameter | Minimum Diameter | 5.0 ~ 100.0 | % | 10.0 |

**4) WEB_11 AccDecWeb : Selecting Acceleration/Deceleration Time Setting at the time of Web Control**

**5) WEB_12 Acc TimeWeb : Acceleration Time at the time of Web Control**

**6) WEB_13 Dec TimeWeb : Deceleration Time at the time of Web Control**

When setting WEB_11 AccDecWeb to "No", WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are not displayed on Keypad, but acceleration/deceleration time of FUN_40 Acc Time-1, FUN_41 Dec Time-1is applied at the time of Web control. When set to "Yes", WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are displayed on Keypad, and then the set value of WEB_12 Acc TimeWeb and WEB_13 Dec TimeWeb are applied to the acceleration/deceleration time, and the reference of acceleration/deceleration reference is "Max Speed".

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_11 | AccDecWeb | Selecting Acceleration/Deceleration Time Setting at the time of Web Control | No<br>Yes | | Yes |
| WEB_12 | Acc TimeWeb | Acceleration Time at the time of Web Control | 0.00 ~ 6000.0 | sec | 0.50 |
| WEB_13 | Dec TimeWeb | Deceleration Time at the time of Web Control | 0.00 ~ 6000.0 | sec | 0.50 |

### 7.7.5 Diameter Computation

**1) WEB_14 Diameter Src : Diameter Computation Type Setting**

This function is the function code that determine whether to calculate the diameter computation by inverter internal S/W or to receive the input diameter via the analog output of the diameter sensor attached to the system through the analog input terminal of the inverter. In case of setting WEB_14 Diameter Src to "Internal", diameter is computed by the inverter internal S/W, while if set to "External", the diameter is input by the diameter sensor. Accordingly, when set to "External", the diameter is not computed in the diameter inverter, and furthermore, the diameter preset function doesn't operate.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_14 | Diameter Src | Diameter Computation Type Setting | Internal<br>External | | Internal |

**2) WEB_15 Diameter LPF : Diameter Computation LPF Time Constant**

When computing the diameter, to avoid the sudden change in diameter you may set low pass filter(LPF). This set value operates with LPF delay time. In case set the set value in large scale, diameter computation becomes slow, while setting in small scale, diameter computation becomes quicker.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_15 | Diameter LPF | Diameter Computation LPF Time Constant | 0.01 ~ 300.00 | sec | 5.00 |

**3) WEB_16 False Core : False Core Value Setting**

In case the diameter received by the inverter through the diameter computation S/W inside the inverter or by the system where the diameter sensor is built in is smaller than the set value in the WEB_16 False Core, it is judged as "False Core". At this time, if one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define is set to "False Core", the set multi-function output is On. The reference of the set value is [%] of the diameter.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_16 | False Core | False Core Value Setting | 0.0 ~ 50.0 | % | 5.0 |

### 7.7.6 Winder setting

**1) WEB_17 Re/Un Wind : Rewind/Unwind Setting**

There are three methods in general at the time of tension control. First, to control the tension of the fixed roll using Bridle Roll or Nip Roll. Second, to wind the Web as in the Winder in which the diameter of Winder get larger as time goes by. Lastly, to unwind the Web as in the Unwinder in which the diameter of Unwinder gets smaller as time goes by. In this function, you may set to "Rewind" in case of winding the web as in the Winder or control the tension of the fixed roll using Bridle Roll or Nip Roll while set to "Unwind" in case of unwinding the web as in the Unwinder.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_17 | Re/Un Wind | Rewind/Unwind Setting | Rewind<br>Unwind | | Rewind |

**2) WEB_18 O/U Wind : Overwind/Underwind Setting**

There are two methods in case of winding or unwinding the web with Winder or Unwinder. First, to wind or unwind the web from up to down centered on the roll. Second, to wind or unwind the web from down to up centered on the roll. This function is the code deciding the way of winding or unwinding the web. According to the set value of the function code, the motor rotating direction is decided. The following figure and the table show the direction of line speed command, PID output command, and splicing command according to WEB_17 Re/Un Wind and WEB_18 O/U Wind settings.

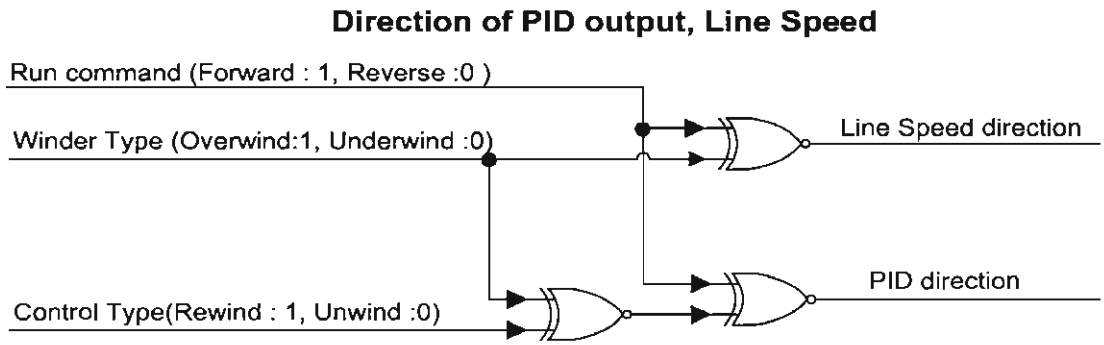
| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_18 | O/U Wind | Overwind/Underwind Setting | Overwind<br>Underwind | | Overwind |

| Wind / Type Items | Rewind | | Unwind | |
|---|---|---|---|---|
| | Overwind | Underwind | Overwind | Underwind |
| Line Speed direction | Positive | Negative | Positive | Negative |
| PID direction | Positive | Negative | Negative | Positive |
| Splicing direction | Positive | Negative | Negative | Positive |

Table 1. Line Speed, PID and Splicing Direction in case of Forward Direction Command

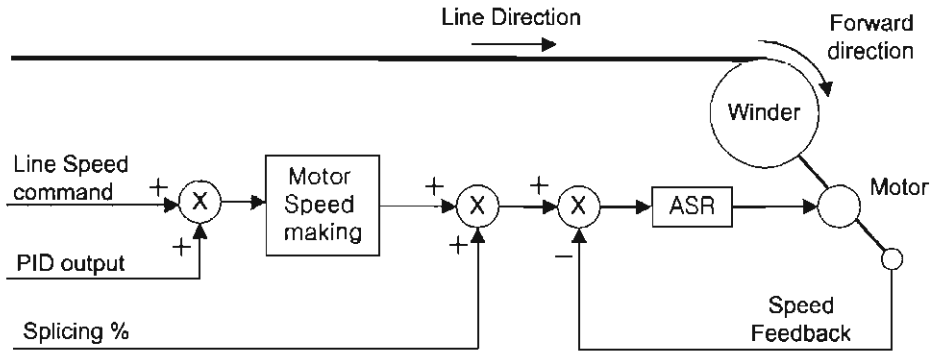
| Wind / Type Items | Rewind | | Unwind | |
|---|---|---|---|---|
| | Over wind | Under wind | Over wind | Under wind |
| Line Speed direction | Negative | Positive | Negative | Positive |
| PID direction | Negative | Positive | Positive | Negative |
| Splicing direction | Negative | Positive | Positive | Negative |

Table 2. Line Speed, PID and Splicing Direction in case of Reverse Direction Command


Direction of PID output, Line Speed
Run command (Forward : 1, Reverse :0 )
Winder Type (Overwind:1, Underwind :0)
Line Speed direction
PID direction
Control Type(Rewind : 1, Unwind :0)

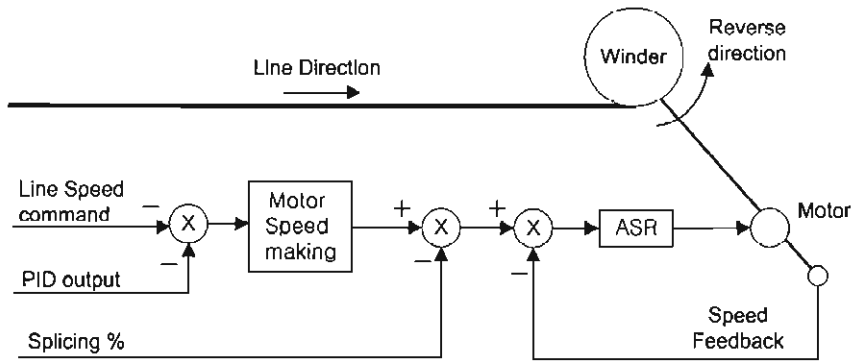
Line Speed, PID direction according to the Command and Function Code

Rewind(Overwind) with Forward Run command



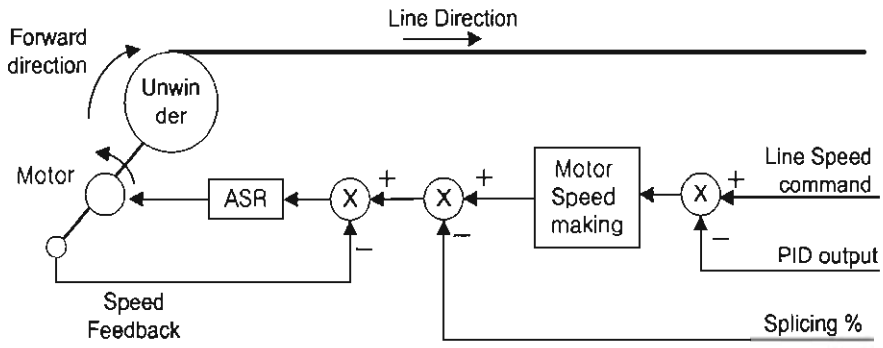

Rewind/Overwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Rewind(Under wind) with Forward Run command



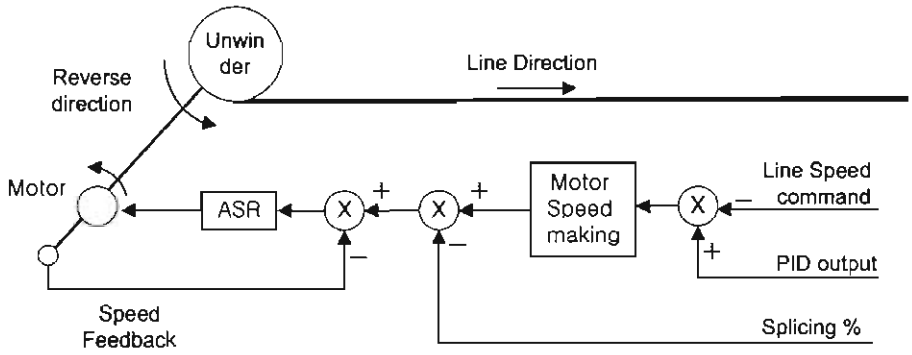

Rewind/Underwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Unwind(Over wind) with Forward Run command




Unwind/Overwind Setting, Roll Rotating Direction in case of Forward Direction Operation

Unwind(Under wind) with Forward Run command




Unwind/Underwind Setting, Roll Rotating Direction in case of Forward Direction Operation

### 7.7.7 Tension controlling setting

#### 1) WEB_19 Tension Input : tension Reference Input Setting

In case of using loadcell in the tension control you have to set tension reference. If using dancer, you have to set the position reference of dancer. In this case, Taper, Stall and Boost are required according to the system requirement. This function code is the function code where tension reference is set when using the loadcell as the tension control-use sensor. Tension reference is input with the sum of the analog input value at the time of setting WEB_19 Tension Input and analog input (Ai1 ~ Ai3 Define) to "Tension Ref" and the set value of Address 0x0511 in common area. For further detail, please refer to Block Diagram at the time of Web Control. In case of using dancer, this function code plays the role giving the dancer Taper function. In case of setting the set value of WEB_28 PIDRef Sel to "Dancer Pos", and setting WEB_29 Dancer Pos, WEB_19 Tension Input can be set with the input tension of the dancer. At this time, you may connect with the dancer after setting one of analog output (AIO_74 AO1 Define, AIO_79 AO2 Define) to "Tension Out".

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_19 | Tension Input | Tension Reference Input | -100.0 ~ 100.0 | % | 0.0 |

#### 2) WEB_20 Taper Type : Taper Type Setting

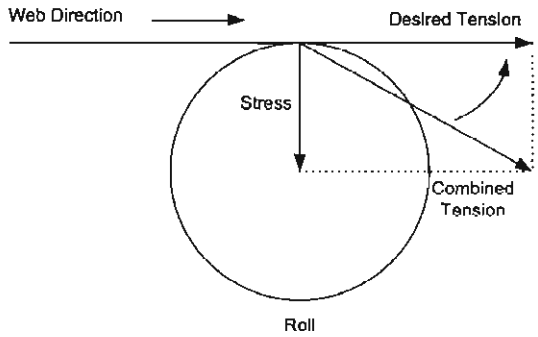
#### 3) WEB_21 Taper Input : Taper Amount Input

In case of Winder, as the diameter gets larger, the tension toward the center direction of the diameter increases. Desired tension is, as shown in the Figure 12, toward the direction of dot line. The tension occurs from the stress, however, and therefore the sum of two vectors work as the total tension. To maintain the tension toward the desired direction, you may use this taper function. There are three methods of using taper function. First; it is not to use taper function, that is tape function is not applicable in case of powering On after setting WEB_20 to "None", setting WEB_20 to the others than "None" but setting WEB_21 Taper Input to 0.0[%], and setting one of multi-function inputs (DIO_01 ~ DIO_07) to "Taper Disable". Second; it is to set to "Hyperbolic" when the tension

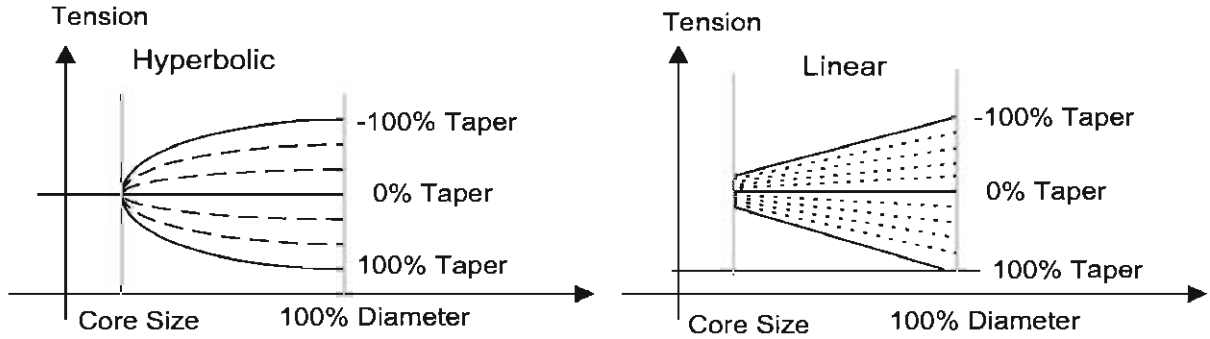
changes showing non-linear behavior depending of the diameter. Third; it is to set to "Linear", when the tension changes showing linear behavior depending on the diameter.

By inputting the amount of taper, the sum of the set value of WEB_21 Taper Input, the input value of analog input terminal set to Taper Ref", and the set value of address 0x0514 in the common area is decided as the amount of final taper. In general, the value larger than 0 is input as the taper input, but in specific case, the value less than 0 can be input, which means as the diameter gets larger, the tension becomes larger.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_20 | Taper Type | Taper Type | None<br>Hyperbolic<br>Linear | | None |
| WEB_21 | Taper Input | Taper Input | -100.0 ~ 100.0 | % | 0.0 |




Tension Composition Diagram




Taper Type and Tension according to the Amount of Taper Set

**4) WEB_22 Boost Type : Boost Type**

**5) WEB_23 Boost Input : Boost Input**

This function is used when Web is wound with the stronger tension than the preset tension. If WEB_22 Boost Type is set to "Fixed", the sum of WEB_23 Boost Input set value and the set value of tension becomes the final set value of tension. For example, with the taper function unused, if the set value of tension is 50[%], and WEB_23 Boost Input set value is 20[%], the final set value of tension becomes 70[%]. If WEB_22 Boost Type is set to "Proportional", the set value of tension multiplying by WEB_23 Boost Input set value is added. For example, with the taper function unused, if the set value of tension 50[%] and WEB_23 Boost Input set value is 20[%], the set

value of final tension becomes 60[%]. In the boost function, the set value of WEB_23 Boost Input is not always 0, but it just operates in case of the multi-function input terminal (DIO_01 ~ DIO_07) set to "Boost Enable" being On.

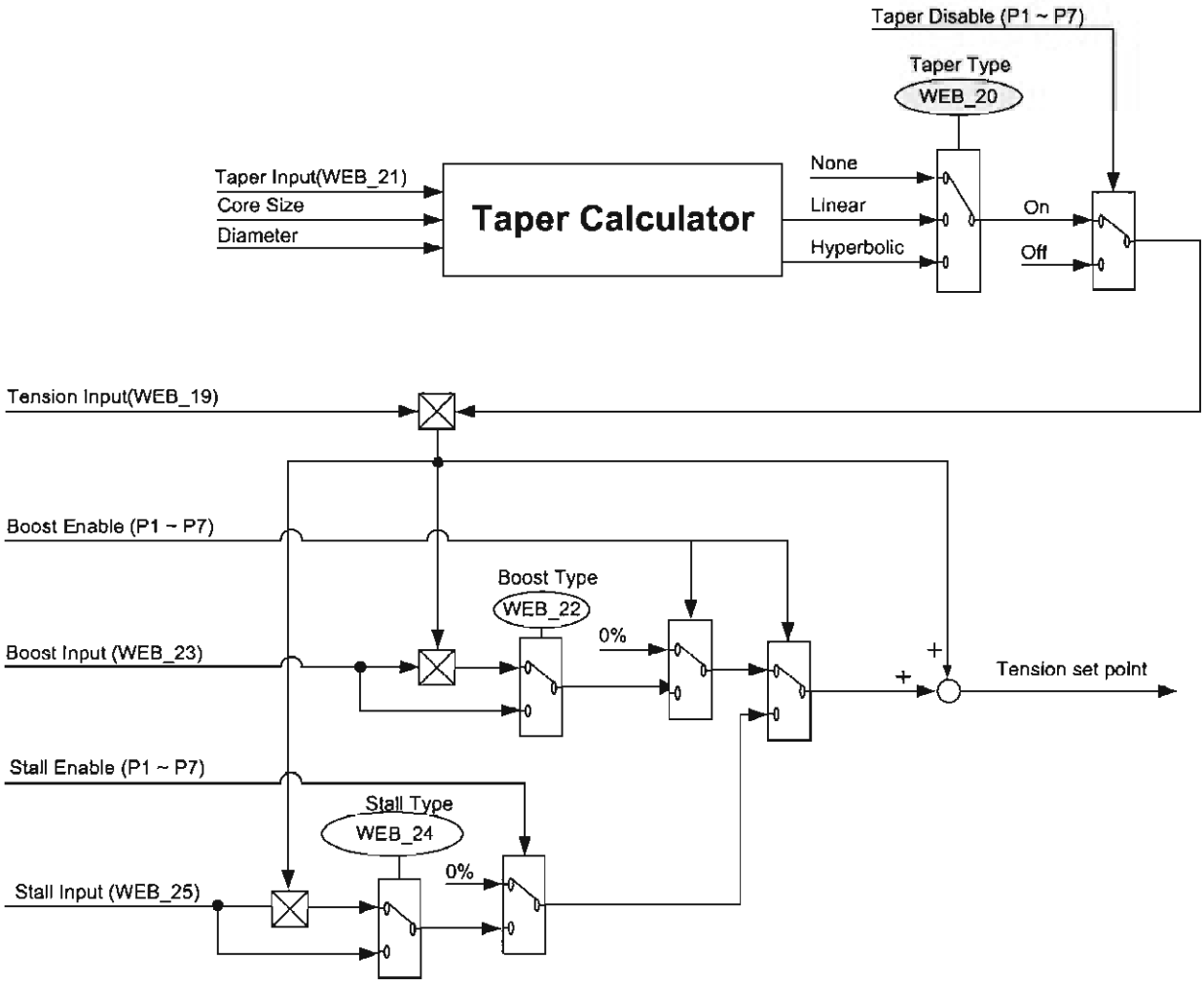
| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_22 | Boost Type | Boost Type | Proportional Fixed | | Proportional |
| WEB_23 | Boost Input | Boost Input | 0.0 ~ 50.0 | % | 0.0 |

**6) WEB_24 Stall Type : Stall Type**

**7) WEB_25 Stall Input : Stall Input**

This function is used when Web is wound with the weaker tension than the preset tension. In case of setting WEB_24 Stall Type to "Fixed", the set value of tension less WEB_25 Stall Input set value becomes the set value of final tension. For example, with the taper function unused, if the set value of tension is 50[%], and WEB_24 Stall Input set value is 20[%], the set value of final tension becomes 30[%]. If WEB_24 Stall Type is set to "Proportional", the set value of tension multiplying by WEB_25 Stall Input set value is subtracted. For example, with the taper function unused, if the set value of tension is 50[%] and WEB_25 Stall Input set value is 20[%], the set value of final tension becomes 40[%]. In the Stall function, the set value of WEB_25 Stall Input is not always 0, but it just operates in case of the multi-function input terminal (DIO_01 ~ DIO_07) set to "Stall Enable" in On.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_24 | Stall Type | Stall Type | Proportional Fixed | | Proportional |
| WEB_25 | Stall Input | Stall Input | 0.0 ~ 50.0 | % | 0.0 |

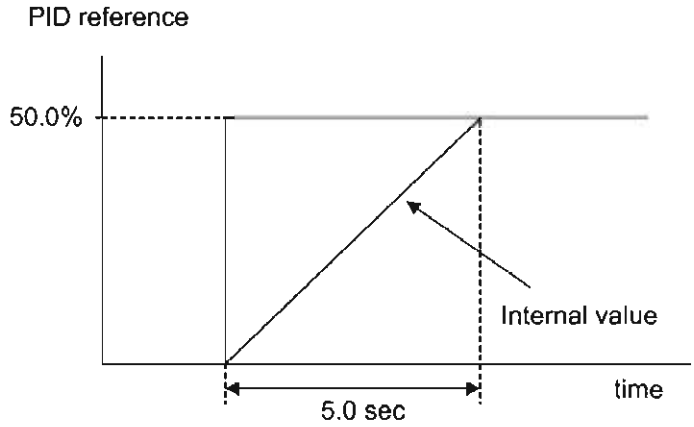



Tension Reference taking Taper, Boost, and Stall into account

**8) WEB_26 Tension Ramp : Setting of Ramp in Tension Reference Input**

When the machinery starts, Web is in loose state because of lower tension. Therefore the sudden tension command at earlier operation stage may cause unexpected change in tension. To avoid such phenomenon when the command value of loadcell or dancer is applied to the step, the change can be led in smooth manner so that the normal PID controller movement can be carried out by setting the ramp time of the tension input command value. If WEB_26 Tension Ramp is set to 10.0[sec], and the final PID command set to 50[%], the tension command will operate as shown in the Figure 15.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_26 | Tension Ramp | Ramp Time of Tension Reference Input | 0.00 ~ 600.00 | sec | 5.00 |

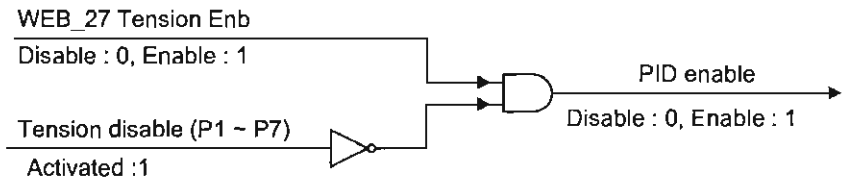



Tension Command where Ramp Time is applied

#### 9) WEB_27 Tension Enb : Setting of Tension Control Enable Function

This is the function of conducting On/Off of the final output of PID controller. If the multi-function input terminal (I/O_01 ~I/O_07) set to "TensionDisable" is Off, and WEB_27 Tension Enb becomes "Enable", PID controller operates. In any other case, PID controller doesn't operates any longer.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_27 | Tension Enb | Tension Control Enable Function Setting | Disable<br>Enable | | Enable |




PID Controller Operation Diagram

### 7.7.8 WEB PID Control

#### 1) WEB_28 PIDRef Sel : PID Reference Type Setting

When loadcell is used at the time of tension control, PID controller controls actual tension. Accordingly, the reference input of PID controller should be the output of taper computation. Therefore, the set value of WEB_28 PIDRef Sel in the tension control where loadcell is used becomes "Taper Out". If dancer is used, it controls the actual dancer position where the set value of WEB_28 PIDRef Sel is "Dancer Pos", and in this case to carry out the tension control of web, you need to set one of analog outputs (AI/O_74 AO1 Define, AIO_79 AO2 Define) to "Tension Out", and then connect it with dancer. At this time WEB_29 Dancer Pos becomes the reference input of PID controller.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_28 | PIDRef Sel | PID Reference Type Setting | Dancer Pos<br>Taper Out | | Taper Out |

**2) WEB_29 Dancer Pos : Dancer Reference Position Setting**

To maintain the desired tension, you should set the reference position of dancer. In this case it follows the reference position value of dancer with the deviation between the reference position of dancer set to WEB_29 Dancer Pos and the actual dancer position fed back from outside using PID controller. The reference position of dancer is the sum of the set value of WEB_29 Dancer Pos and "Dancer Ref" set to Analog inputs (AIO_01 Ai1 Define, AIO_13 Ai2 Define, AIO_25 Ai3 Define).

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_29 | Dancer Pos | Dancer Reference Position | -100.0 ~ 100.0 | % | 0.0 |

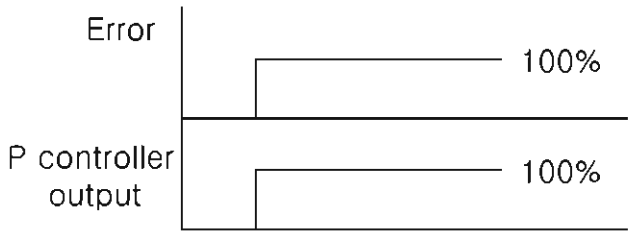
**3) WEB_30 ProcPID Kp1 : Process PID Kp1 Gain Setting**

**4) WEB_31 ProcPID Kp2 : Process PID Kp2 Gain Setting**

P Gain means the output of PID controller becomes 100[%] when 100% error is maintained where I Gain is 0. Furthermore, P Gain 50[%] means the output of PID controller becomes 50[%] when 100% error is maintained where I Gain is 0.

When setting multi-function input(DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On, P Gain is transferred from WEB_30 ProcPID Kp1 to WEB_31 ProcPID Kp2 during WEB_34 PIDGain RAMP Time. For further detail on gain transfer, please refer to WEB_34 PIDGain RAMP.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_30 | ProcPID Kp1 | Process PID P1 Gain Setting | 0.0 ~ 999.9 | % | 100.0 |
| WEB_31 | ProcPID Kp2 | Process PID P2 Gain Setting | 0.0 ~ 999.9 | % | 0.0 |



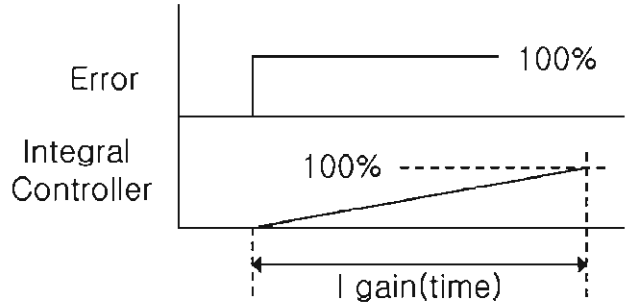

P controller

**5) WEB_32 ProcPID Ki1 : Process PID Ki1 Gain Setting**

**6) WEB_33 ProcPID Ki2 : Process PID Ki2 Gain Setting**

I Gain 1[sec] means the time taken for the output to be accumulated up to 100[%] when 100[%] Error is maintained where P Gain is 0. After setting the multi-function input (DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On, I Gain is transferred from WEB_32 ProcPID Ki1 to WEB_33 ProcPID Ki2 during the WEB_34 PIDGain RAMP Time. For further detail on gain transfer, please refer to WEB_34 PIDGain RAMP.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_32 | ProcPID Ki1 | Process PID I1 Gain Setting | 0.0 ~ 100.0 | sec | 5.0 |
| WEB_33 | ProcPID Ki2 | Process PID I2 Gain Setting | 0.0 ~ 100.0 | sec | 0.0 |

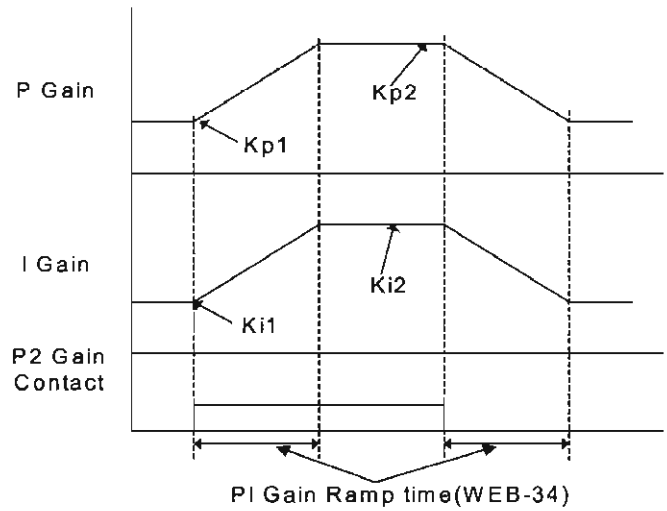



**I controller**

**7) WEB_34 PIDGain RAMP : PID Gain Ramp Time Setting**

Sudden change in PI Gain may cause unexpected oscillation. To avoid such phenomenon, you need to carry out setting in slow way for a certain period of time when you transfer gain. This is the function of transferring the gain as shown in the Figure when setting multi-function input(DIO_01 ~ DIO_07) to "PI Gain Sel" and then powering it On.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_34 | PIDGain RAMP | PID Gain Ramp Time Setting | 0.1 ~ 100.0 | sec | 1.0 |



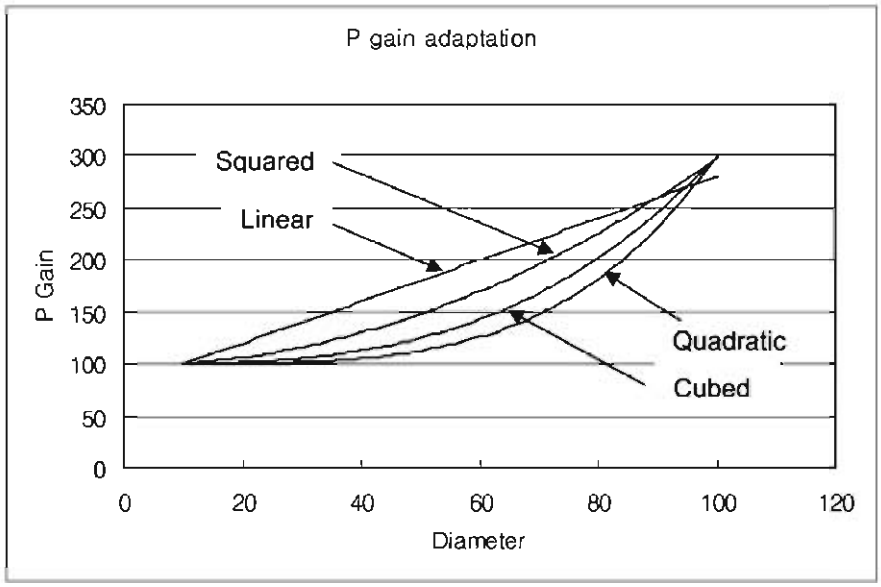

**PI Gain Ramp Time**

**8) WEB_35 P Profiler : Process PID P Gain Profiler Type Setting**

**9) WEB_36 P Apt Gain : Process PID P Gain Profiler Gain Setting**

In case of Winder, the inertia increases as the diameter increases when winding the web. Therefore, P Gain has to change to achieve the same winding performance regardless of the increase of inertia following the increased diameter. There exist four (4) types of profiles; Linear, Square, Cubed, and Quadratic being decided in accordance with the kind of web. WEB_35 P Profiler is the function code that sets the type of P Gain Profiler, while WEB_37 P Apt Gain is the function code that sets the gain applicable to P Gain Profiler. If WEB_36 P Apt Gain is set as 0, Profiler function doesn't operate..

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_35 | P Profiler | Process PID P Gain Profiler Type Setting | Linear<br>Square<br>Cubed<br>Quadratic | | Linear |
| WEB_36 | P Apt Gain | Process PID P Gain Profiler Gain Setting | -1.00 ~ 10.00 | | 0.00 |




P Gain applicable where P Gain : 100.0[%], Adaptation Gain : 2.00, Core Size : 10.0[%]



**10) WEB_37 ProcPID Kd : Process PID D Gain**

**11) WEB_38 ProcKd LPF : Process PID D Gain LPF Time Constant**

WEB_37 ProcPID Kd and WEB_38 ProcKd LPF constitute D controller of Process PID controller. When the error deviation is 100[%] where WEB_37 ProcPID Kd setting is 100 [%], it means D controller output before going through LPF is 100 [%]. Without LPF, D controller generates outputs when the error changes only. As this characteristic makes the system unstable, LPF is a necessary function in D controller.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_37 | ProcPID Kd | Process PID D Gain Setting | 0.0 ~ 100.0 | % | 0.0 |
| WEB_38 | ProcKd LPF | Process PID D Gain<br>LPF Time Constant | 0.0 ~ 100.0 | sec | 2.0 |

**12) WEB_39 Proc Pos Lmt : Process PID Positive Limit Setting**

**13) WEB_40 Proc Neg Lmt : Process PID Negative Limit Setting**

WEB_39 Proc Pos Lmt and WEB_40 Proc Neg Lmt are the upper and lower limits of the final output of Process PID controller. WEB_39 Proc Pos Lmt sets the (+) limit of PID controller output value, while WEB_40 Proc Neg Lmt sets (-) limit of PID controller output value. This function expresses the PID controller output in % value. For example, if error is 100[%] and P Gain of PID controller is set as 200[%], the output of PID controller before restricted becomes

200[%]. If the upper limit of PID controller is set as 100[%], however, the final output of PID controller becomes 100[%].

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_39 | Proc Pos Lmt | Process PID Positive Limit | -100.0 ~ 100.0 | % | 100.0 |
| WEB_40 | Proc Neg Lmt | Process PID Negative Limit | -100.0 ~ 100.0 | % | -100.0 |

**14) WEB_41 PID Out LPF : Process PID output LPF**

This function sets LPF time constant against the process PID controller final output value. As the time constant increases, the responsiveness of PID controller output gets slower, but its stability increases.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_41 | PID Out LPF | Process PID output LPF | 0.00 ~ 100.00 | sec | 1.00 |

**15) WEB_42 PIDOGainRe : Rewind-use Process PID Output Gain**

**16) WEB_43 PIDOGainUn : Unwind-use Process PID Output Gain**

This function sets the final output gain of Process PID controller. You may set WEB_42 PIDOGainRe in case of winding the web , that is, when setting "Rewind" in WEB_17 Re/Un Wind. On the contrary, you may set WEB_43 in case of unwinding the web, that is when setting "Unwind" in WEB_17 Re/Un Wind. The set value is the [%] value against the maximum line speed command. For example, if you set WEB_44 PID Type to "Fixed" and PID output Gain to 10[%] where the line speed command is 50[%], the final line speed command becomes 60[%]. In case the set value of PID output Gain is (-), PID controller operates in reverse direction. This is useful in the sensor in inverse proportion. For example, if the highest pressure falls under the 0[V] voltage of loadcell and the final pressure falls under 10[V] voltage of loadcell, you may use it by setting PID output Gain as (-) value.

**In case of Process PID control, if the line speed command is 0 where PID output is in minus value, the motor may rotate in reverse direction. To avoid this, iV5 is programmed in such manner that it cannot be operated in reverse direction when the PID output is larger than the line speed command in internal S/W.**

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_42 | PIDOGainRe | Rewind-use Process PID Output Gain | -250.0 ~ 250.0 | % | 0.0 |
| WEB_43 | PIDOGainUn | Unwind-use Process PID Output Gain | -250.0 ~ 250.0 | % | 0.0 |

**17) WEB_44 PID Type : PID Controller Type Setting**

**18) WEB_45 Min FPID : Minimum PID Output Setting**

In this function, there are two (2) types of Process PID controllers. If WEB_44 PID Type is set to "Fixed", a certain value of PID controller is output regardless of the line speed command. That is, the final line speed command is the sum of line speed command and PID output. For example, if the line speed command is 50[%] and PID output is 10[%], the final line speed command becomes 60[%]. If the line speed command is changed from 50[%]

to 60[%], the final line speed command becomes 70[%].

**A.** When WEB_44 PID Type is "Fixed", the final line speed command is;

Final Line Speed Command [%] = Line Speed Command [%] + PID Output [%]

When WEB_44 PID Type is set to "Proportional", PID output is generated in proportion with the line speed command. That is, the final line speed command is the sum of line speed command and the PID output in proportion with the line speed command. For example, if the speed command is 50[%] and PID output is 10[%], the final line speed command becomes 55[%]. In this case, the line speed command is larger than the set value of WEB_45 Min FPID.

**B.** When WEB_44 PID Type is "Proportional", the final line speed command (in case of line speed command > WEB_45 Min FPID) is;

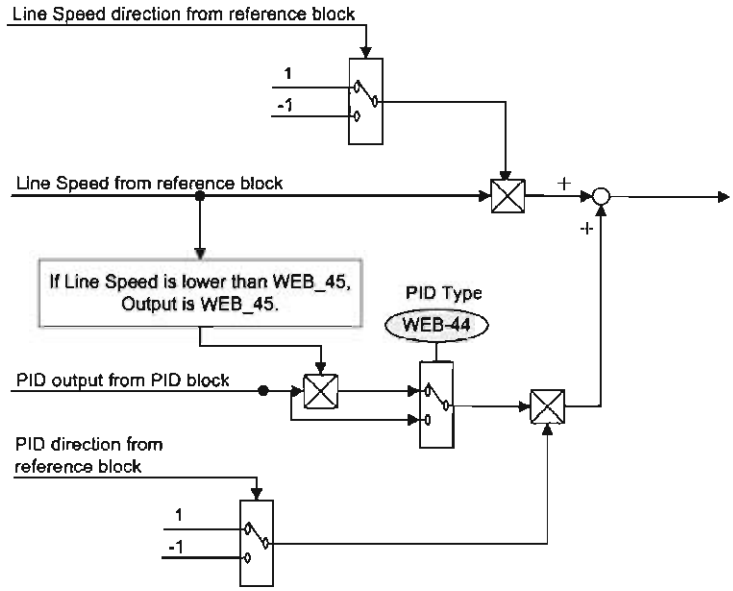
$$\text{Final Line Speed Command [\%]} = \text{Line Speed Command [\%]} + \frac{\text{PID Output [\%] x Line Speed Command [\%]/100}}{100}$$

In case of initial operation, the system should maintain the tension of web starting with initial web tension and 0[%] speed command in possession. In the above formula, if the line speed command is 0[%], the final line speed command becomes 0[%], where the tension of web cannot be maintained. Accordingly, to maintain the tension of web, if the line speed command is less than WEB_45 Min FPID, the final line speed command under the following formula can be applied.

**C.** When WEB_44 PID Type is "Proportional", the final line speed command (In case of line speed command < WEB_45 Min FPID) is;

$$\text{Final Line Speed Command}[\%] = \text{Line Speed Command}[\%] + \frac{PID\ \text{Output}[\%] \times WEB\_45}{100}$$

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_44 | PID Type | PID Controller Type Setting | 0 (Proportional)<br>1 (Fixed) | | 0 (Proportional) |
| WEB_45 | Min FPID | Minimum PID Output Setting | 0.0 ~ 50.0 | % | 10.0 |




PID Type Block Diagram

**19) WEB_46 PIDHoldTime : PID controller Maintenance Time after Hold**

In case of Inverter Hold Command, the motor speed is reduced to 0. In case the output deviation of Process PID controller exists, the motor is operated by the deviation of PID output. To avoid this, this is the function where it conducts PID operation for the period of time set to WEB_46 PIDHoldTime, and then the motor carries out free run and stops by the friction force of the system. If the output of Process PID is 0, the motor stops regardless of the time set to WEB_46 PIDHoldTime.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_46 | PIDHoldTime | PID Controller Maintenance Time after Hold | 0.0 ~ 100.0 | sec | 5.00 |

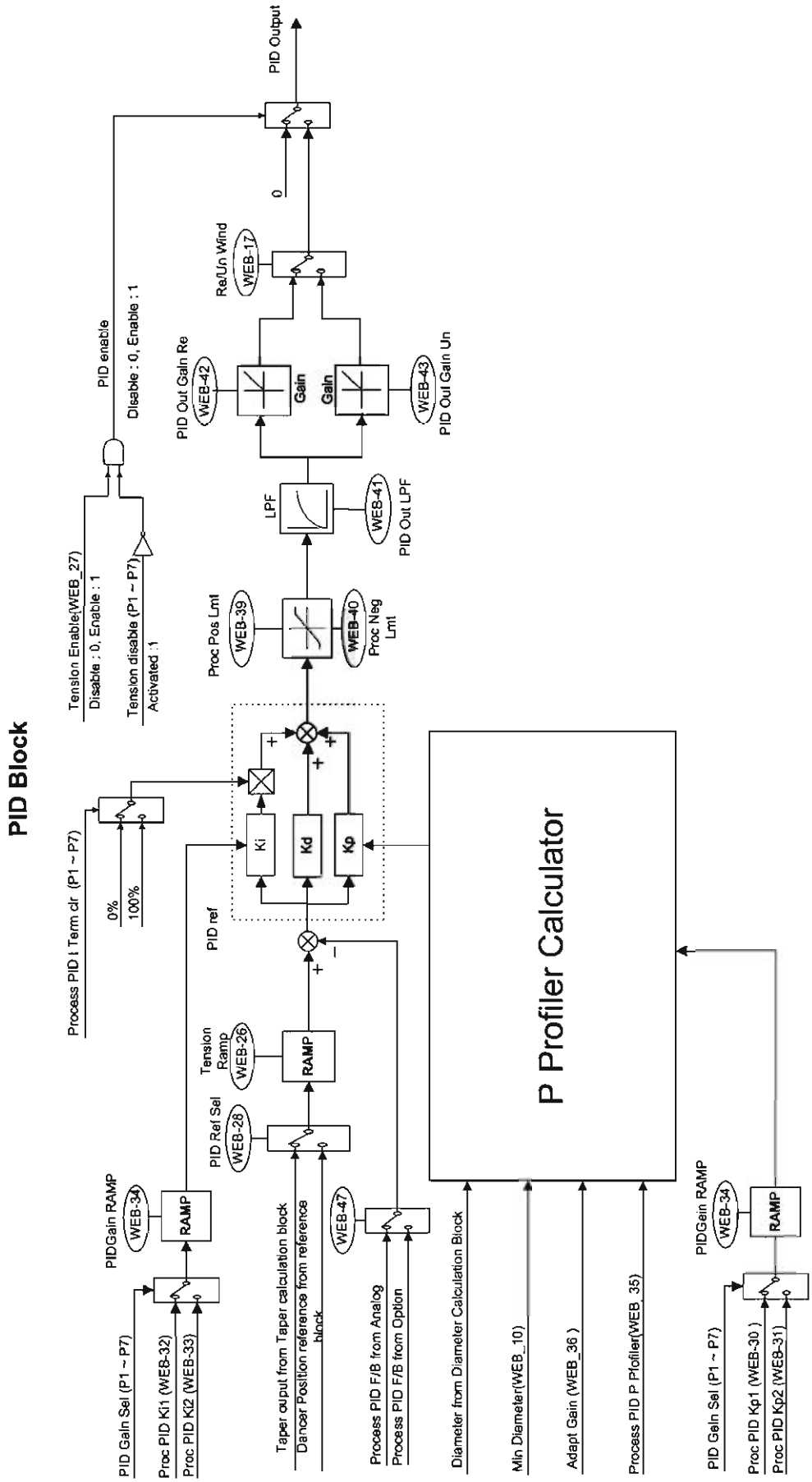
**20) WEB_47 PID F/B Src : Process PID Feedback Source Setting**

WEB_47 PID F/B Src is the function where the feedback source is set when Process PID controller is used. When set to "Analog", the definition of analog input terminal (AIO_01, AIO_13, AIO_25) is set to "Tension F/B", and such amount of feedback is input to the inverter. In this case, the amount of feedback is "0" unless the terminal is defined . In case set to "Option", it is to input the amount of feedback to inverter through communication. In this case, the amount of feedback is "0" unless such value is input.

**In case of setting to "Option", please conduct communication cycle not exceeding 10[ms].**

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_47 | PID F/B Src | PID Feedback Source | Analog<br>Option | | Analog |

## PID Block



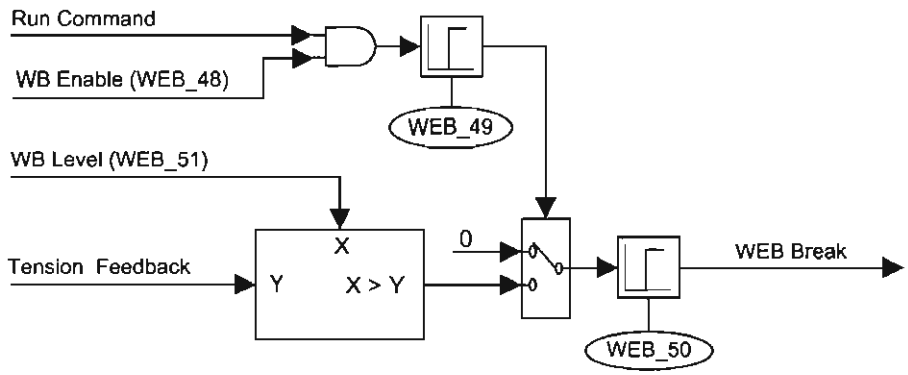

Process PID Block Diagram

### 7.7.9 WEB Break Setting

1) **WEB_48 WB Enable : WEB Break Detection Function Setting**
2) **WEB_49 INV WB Delay : Setting of Delayed Time until WEB Break Detection after Inverter Operation**
3) **WEB_50 WB Delay : Delayed Time in WEB Break Detection**
4) **WEB_51 WB Level : WEB Break Detection Level**

In the web control mode, the web is broken if it has tension it can bear. In this case, if the system continues the web control without such breakage of the web detected, it may cause more serious accident. Accordingly, the inverter is set so as to force the output of PID controller to be "0" when the web breakage is detected, when the diameter computation is not carried out. Furthermore, if one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define of the Inverter is set to "WEB Break", it lets out the output contact point showing the state of ""breakage". In WEB_48 WB Enable mode, you can set WEB Break Detection function. If it is set to "Yes", please set the multi-function output and conduct its connection so that the higher-level controller can receive the output. In case of WEB_49 INV WB Delay, for a certain period of time from the moment the inverter received the operation command, it has lower value of tension feedback, and accordingly it can be misjudged as web break. This is the function, for such situation, not to detect the web break for a certain period of time set in WEB_49 INV WB Delay since the moment the inverter has started the operation. There exists a number of noises in the actual site, and because of such external factor, the amount of feedback less than the set value can be posted at some moment in WEB_51 WB Level, which can be judged as WEB Break. Therefore, WEB_50 WB Delay sets WEB Break Detection Delayed Time. WEB_51 WB Level is the code to set WEB Break Detection Level where the amount of tension feedback is set in [%] value.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_48 | WB Enable | WEB Break Detection Function Setting | No<br>Yes | | No |
| WEB_49 | INV WB Delay | Delayed Time until Web Break Detection after Inverter Operation | 0.1 ~ 600.0 | sec | 1.0 |
| WEB_50 | WB Delay | Delayed Time in WEB Break Detection | 0.1 ~ 600.0 | sec | 1.0 |
| WEB_51 | WB Level | WEB Break Detection Level | 0.0 ~ 100.0 | % | 0.0 |




WEB Break Block Diagram

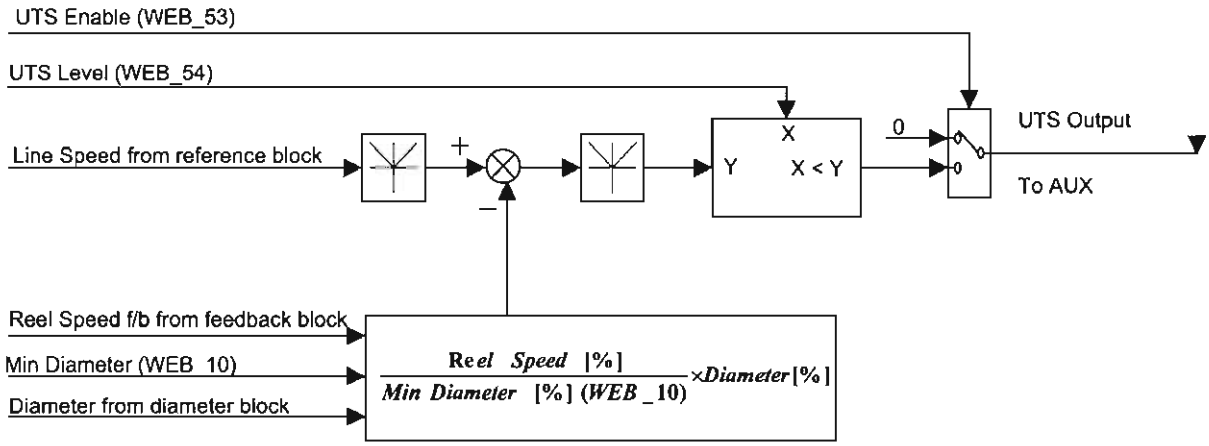
### 7.7.10 Up to Speed Setting

**1) WEB_52 UTS Enable : Up to Speed Judgment Setting**

**2) WEB_53 UTS Level : Up to Speed Level Setting**

When Web control is operates in smooth manner, the line speed command is almost similar to the actual line speed. It is because Process PID controller operates reducing such deviation when there occurs the deviation between line speed command and actual line speed. However, too quick line speed command, problem of the motor or mechanical problem can lead to the discrepancy of the line speed command. This may cause serious problem to the system. WEB_52 UTS Enable and WEB_53 UTS Level are the functions to judge such situations. If the deviation between line speed command and actual line speed is larger than WEB_53 UTS Level, and one of multi-function output DIO_41 AX1 Define ~ DIO_43 OC1 Define is set to "Up to Spd", it can be acknowledged when you let out the output contact point. WEB_53 UTS Level is the [%] value against the line speed command. It has 2[%] Band to avoid chattering. **If the set value of WEB_53 UTS Level is too low, fault operation may happen by the excessive state even near the set level.**

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_52 | UTS Enable | Up to Speed Judgment Setting | No<br>Yes | | No |
| WEB_53 | UTS Level | Up to Speed Level Setting | 0.0 ~ 100.0 | % | 0.0 |




Up to Speed Block Diagram

### 7.7.11 WEB_54 Quick Stop : Quick Stop Time Setting

It is the function where emergency stop is available when the emergency occurs during sequential operation. If the multi-function input terminal (DIO_01 ~ DIO_07) set to "Quick Stop" is On, it conducts emergency stop maintaining the tension of web for the same deceleration time regardless of the current motor rotating speed, that is, the period of time set to WEB_54 Quick Stop. Even after it completely stopped, the tension of the web is still kept. For example, if the winder roll speed is 170[rpm] and the gear ratio is 10:1, the motor rotating speed is 1700[rpm]. If unwinder

roll speed is 140[rpm] and the gear ratio is 11:1, the motor rotating speed is 1540[rpm]. In this case, if the set value of WEB_54 Quick Stop of such two inverters is 5[sec], it stops after 5[sec] although the rotating speed of two motors are not same where the multi-function input terminal (DIO_01 ~ DIO_07) set to "Quick Stop" is On.

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_54 | Quick Stop | Quick Stop Time Setting | 0.0 ~ 100.0 | sec | 1.0 |

### 7.7.12 WEB Jog Setting

1) **WEB_55 JogSpd Web : Jog Speed Setting**
2) **WEB_56 JogTime Sel : Jog Acceleration/Deceleration Time Setting Select**
3) **WEB_57 JogAcc Time : Jog "Acceleration Time Setting**
4) **WEB_58 JogDec Time : Jog Deceleration Time Setting**

If the multi-function input (DIO_01 ~ DIO_07) set to "Jog Web" is On, Process PID controller operates, but doesn't conduct diameter computation. In this case the set value of WEB_55 JogSpd Web is calculated in % of WEB_08 MaxMotor SPD, deciding the motor rotating speed. For example, if the set value of WEB_08 MaxMotor SPD is 300[rpm] and the jog speed set to WEB_55 JogSpd Web is 20[%] where the multi-function input (DIO_01 ~ DIO_07) set to "Jog Web" becomes O, the motor rotating speed is 60[rpm]. In case of jog operation, the jog can set the Acceleration/Deceleration Time instead of the basic Acceleration/Deceleration Time (FUN_40 Acc Time-1, FUN_41 Dec Time-1). When WEB_56 JogTime Sel is set to "No", the basic Acceleration/Deceleration Time is applied during jog operation mode, while when set to "Yes", WEB_57 JogAcc Time and WEB_58 JogDec Time are applied during jog operation mode.

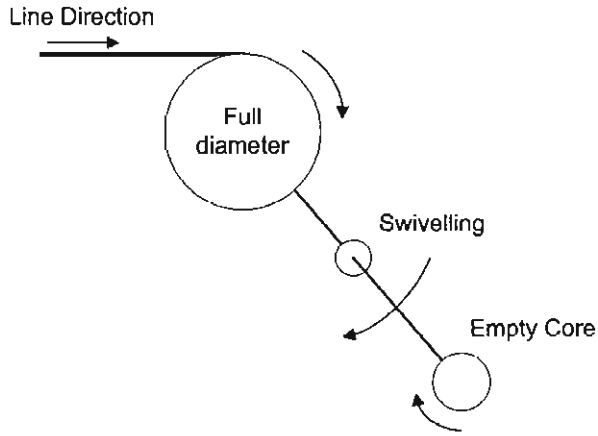
| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_55 | JogSpd Web | Jog speed Setting | 0.0 ~ 100.0 | % | 10.0 |
| WEB_56 | JogTime Sel | Jog Acceleration/Deceleration Time Setting Select | No<br>Yes | | Yes |
| WEB_57 | JogAcc Time | Jog Acceleration Time | 0.00 ~ 6000.0 | sec | 5.00 |
| WEB_58 | JogDec Time | Jog Deceleration Time | 0.00 ~ 6000.0 | sec | 5.00 |

### 7.7.13 Splicing Level Setting

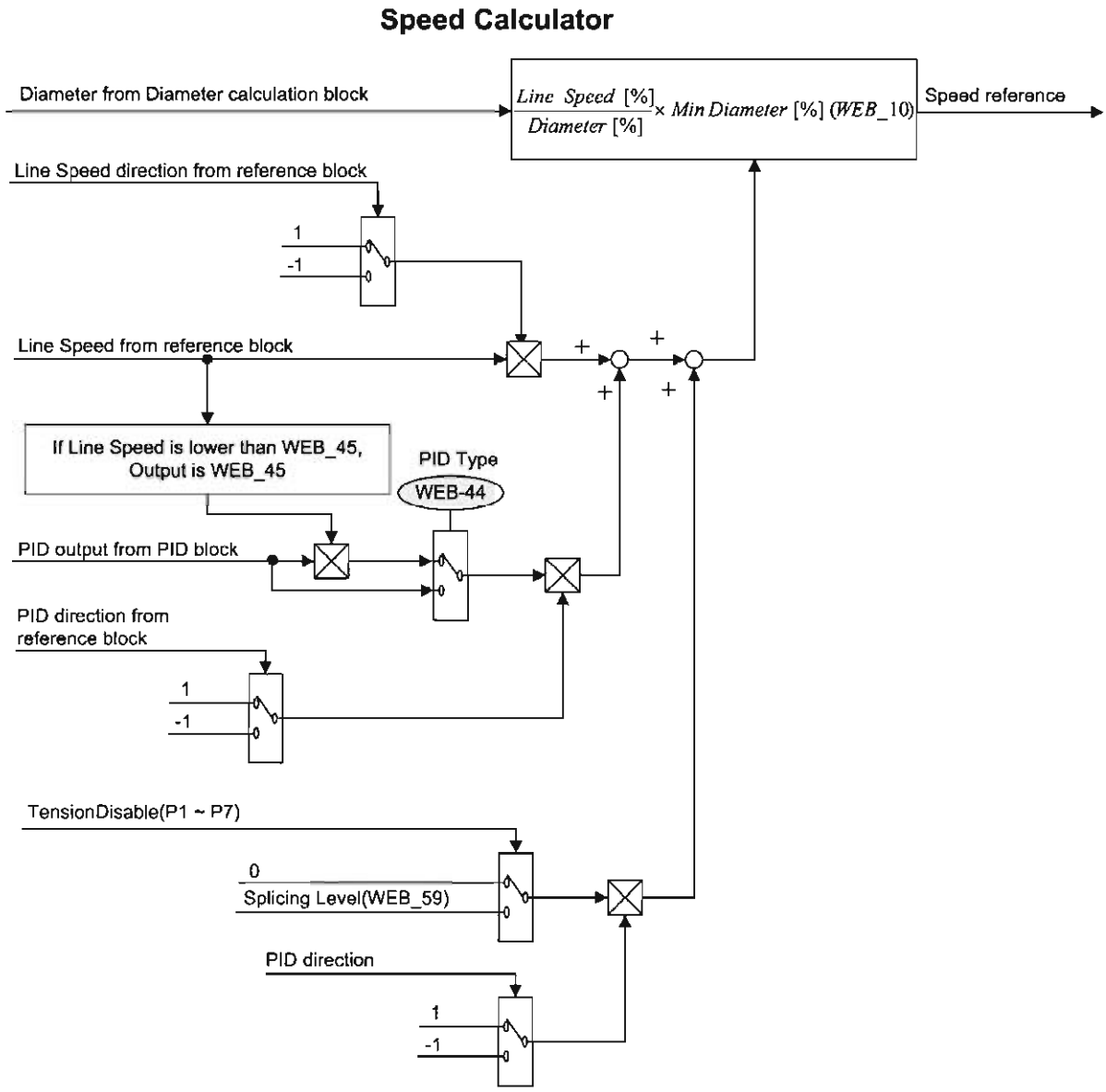
In the splicing system, the winder core should be replaced without any change in line speed command. When splicing, the process PID controller doesn't operate in the empty core. Therefore, the multi-function input terminal (DIO_01 ~ DIO_07) set to "TensionDisable" should be On. The splicing function doesn't operate during jog operation. In case the web is wound in new core in the winder, sudden load change occurs. Such sudden change in load makes the speed slower, which causes low tension of web, and finally the web becomes drooped. To avoid such phenomenon, you may operate it at higher speed than the line speed command in splicing state. WEB_59 Splice Level is the [%] value for the line speed command. For example, if the line speed command is 50[m/m], and the set value of WEB_59 Splice Level

Is 10[%], the final line speed command of the empty core at the time of splicing operation becomes 55[m/m].

| Function Code | Loader Display | Name of Function | Set Range | Unit | Factory Default |
|---|---|---|---|---|---|
| WEB_59 | Splice Level | Splicing Level Setting | 0.0 ~ 100.0 | % | 0.0 |




Splicing Operation Status Diagram




Line Speed Command Block Diagram

# Chapter 8 – Inspection and Replacement

**The iV5 series is an industrial electronic product with advanced semiconductor elements. However, temperature, humidity, vibration and aging parts may still affect it. To avoid this, it is recommended to perform routine inspections.**

## 8.1 Precautions

### ⚠ CAUTION

- Be sure to remove the drive power input while performing maintenance.
- Be sure to perform maintenance only after checking that the bus has discharged. The bus capacitors in the electronic circuit can still be charged even after the power is turned off.
- The correct output voltage can only be measured by using a rectifier voltage meter. Other voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

## 8.2 Inspection

**1) Routine Inspection**

Be sure to check the following before operation:

- The conditions of the installation location
- The conditions of the drive cooling
- Abnormal vibration
- Abnormal heating

**2) Periodical Inspection**

- Are there any loose bolt, nut or rust caused by surrounding conditions? If so, tighten them up or replace them.
- Are there any deposits inside the drive-cooling fan? If so, remove using air.
- Are there any deposits on the drive's PCB (Printed Circuit Boards)? If so, remove using air.
- Are there any abnormalities in the various connectors of the drive's PCB? If so, check the condition of the connector in question.

**3) Megger test**

① For Exterior main circuit, remove all cables from inverter terminals to ensure that test voltage is not applied to the inverter.

② Use DC 500V meggar and isolate the main power before starting measurement. If the test voltage is connected to the control circuit, remove all connection cables to the control circuit.

③ Perform the Meggar test only between the common cables connected to the main circuit and ground.

## 8.3 Parts replacement

| Part name | Period | Comments |
|---|---|---|
| Cooling fan | 2 years | Exchange for a new part after consulting LS A/S center. |
| Electrolytic capacitor on the PCB board | 3 years | Exchange for a new part after consulting LS A/S center. |
| Relay on the PCB board | - | Exchange for a new part after consulting LS A/S center. |
| DC Resistor | - | Exchange for a new part after consulting LS A/S center. |

- The life expectancy of a part depends on the type of part, the environment, and operating conditions.

# Chapter 9 – Troubleshooting and Maintenance

## 9.1 Fault Display

**⚠ CAUTION**

When a fault occurs, the inverter turns off its output and displays the fault status described below. In this case, the cause must be corrected before the fault can be cleared. If protective function keeps active, it could lead to reduction in product life and damage to the equipment.

| Protective function | Keypad display | Description |
|---|---|---|
| Over Current | OC-U<br>OC-V<br>OC-W | The inverter turns off its output when the output current of the inverter flows more than 200% of the inverter rated current. |
| Ground Fault Protection | Ground Fault | The inverter turns off its output when a ground fault occurs and the ground fault current is more than the internal setting value of the inverter. Over current trip function may protect the inverter when a ground fault occurs due to a low ground fault resistance |
| Over voltage protection | Over Voltage | The inverter turns off its output if the DC voltage of the main circuit increases higher than the rated value (200V class: 400V DC, 400V class: 820 V DC) when the motor decelerates or when regenerative energy flows back to the inverter due to a regenerative load. This fault can also occur due to a surge voltage generated at the power supply system. |
| Low Voltage Protection | Low Voltage | The inverter turns off its output if the DC voltage is below the detection level because insufficient torque or over heating of the motor can occurs when the input voltage of the inverter drops. |
| Overload Protection | Over Load | The inverter turns off its output if the output current of the inverter flows at 180% of the inverter rated current for more than the current limit time (S/W). |
| Inverter Overload | Inv OLT | The inverter turns off its output when the rated current of the inverter flows more than regulation level(150% for 1 minute-Inversely proportional to time). |
| Heat Sink Over Heat | InvOver Heat | The inverter turns off its output if the heat sink over heats due to a damaged cooling fan or an alien substance in the cooling fan by detecting the temperature of the heat sink. |
| | OHD Open *1) | The inverter turns off its output when OHD is opened and the heat sink is overheated. |
| Inverter NTC Thermistor Open | InvThem OP | When inverter NTC Thermistor is open, inverter stops its output. |
| Motor overheat | MotOver Heat | When motor temp exceeds 150℃ , inverter stops its output to protect motor from overheated. |
| Motor Thermistor Error | MotThem Err | When there is an error in Thermistor that measures the temperature of motor, inverter stops its output. (Error—NTC: open , PTC: short-circuit) |
| Electronic Thermal | E-Thermal | The internal electronic thermal of the inverter determines the over heating of the motor. If the motor is overloaded the inverter turns off the output. The inverter cannot protect the motor when driving a multi-pole motor or when driving multiple motors, so consider thermal relays or other thermal protective devices for each motor. Overload capacity: 150% for 1 min. |
| External fault B | Ext Trip-B | Use this function if the user needs to turn off the output by an external fault signal. |

***1) It only comes under** SV2800~3750iV5

| Protective function | Keypad display | Description |
|---|---|---|
| IGBT Short | Arm Short-U<br>Arm Short-V<br>Arm Short-W | Inverter output is stopped when IGBT Arm short or output short occurs.<br>(Arm short-DB is only come under SV110~220iV5)<br>(SV2800~3750iV5 are displayed as ArmShort without reference to UVW phases.) |
| Fuse Open | Fuse Open | The inverter turns off its output by opening the fuse when something is wrong with the main circuit IGBT to protect the wiring from being damaged from short currents |
| Encoder Error | Encoder Err | 1) Displayed when Encoder signal fault occurs.(H/W)<br>2) Displayed when there is a discord of detection time standard of motor error of PAR-14.(S/W) |
| BX protection (Instant Cut Off) | BX | Used for the emergency stop of the inverter. The inverter instantly turns off the output when the BX terminal is turned ON, and returns to regular operation when the BX terminal is turned OFF. Take caution when using this function. |
| Motor overspeed | Over Speed | Displayed when motor rotates over 120% its rated speed. |
| Communication Error | COM Error<br>CPU Error | This fault is displayed when the inverter cannot communicate with the keypad. |
| H/W Error | HW- Diag | Displayed when CPU has a problem, and then the inverter blocks the IGBT gating signals. |
| FAN Lock*1) | FAN Lock | The inverter turns off its output when there is an Fan Lock. |
| Encoder PowerError*1) | EPR | When there is an error in Encoder power source, the inverter turns off its ouput. Converted to initial screen and displayed "EPR" on the right upper side. |

***1) It only comes under** SV2800~3750iV5

## 9.2 Monitoring Fault Condition

### 9.2.1 Monitoring fault display

| Code | LCD display | Description |
|---|---|---|
| DIS_05 | OC-U | Current fault displayed. (U-phase overcurrent) |

- Check the current fault display before pressing reset key. pressing [PROG] key and [▲(Up)],[▼(Down)] shows operating status at the time of the fault such as output frequency, current, voltage, F/B value, torque current reference/actual value, dc link voltage, input/output terminal status, operating status and run time) and the fault contents. Press [ENT] key to exit. Pressing [RESET] key will store the value in DIS_05 [Last Fault1].

### 9.2.2 Monitoring previous faults

- Previous 2 faults are saved in DIS_05 "Last fault 1/2". Last fault 1 is more recent fault than Last fault 2. Refer to "8.2.1 monitoring fault display" to check the fault contents.

| Code | LCD display | Description |
|---|---|---|
| DIS_05 | Last Fault1 | Previous fault 1 |
| DIS_05 | Last Fault2 | Previous fault 2 |

- DIS_05 " Fault Clear" removes Last Fault1, Last Fault2 data.

## 9.3 Fault Reset

There are 3 ways to reset the inverter. After performing this, the number of automatic restart is initialized.

1) Use [RESET] key on the keypad.

2) Short the RST-CM terminal to reset.

3) Cycle the power (turn the power OFF and turn it ON).

## 9.4 Fault Remedy

### 9.4.1 Check the below diagnosis before troubleshooting.

1) Is the wiring of a motor and an inverter conducted correctly?

☞ Refer to Main Circuit Terminal

2) Is the Encoder-type jumper on I/O PCB set correctly?

☞ Refer to Encoder wiring

If encoder type is either Complementary or Open collector, slide JP4 switch to "OC" and slide JP2 switch to "P15". If encoder type is Line Drive, slid the JP4 switch to "LD" and slide JP2 switch to "P5".

Factory default: Line Drive Type

3) Is motor rotating direction set correctly?

☞ Refer to Monitoring Encoder operation. (Refer to 4-10p.)

**STARVERT-iV5 defines Forward rotation when motor rotates in clockwise from the view of Rear Bracket (Motor FAN).**

4) Is inverter operating correctly in no load condition?

☞ Refer to Operation via Keypad and Control Terminal

### 9.4.2 Check list before installation

Check (1) ~ (9) before installation. Check (10) ~ (16) when problem has occurred during use.

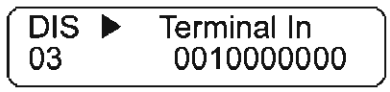
**1) The Motor Does Not Rotate**

① Is red lamp blinking ?

☞ Check whether other trips occur in DIS_05.

If fault occurs, press [RESET] key to clear trip status and try operation.

☞ Check whether BX (Emergency stop) signal is applied on keypad and input terminal defined as BX is ON in DIS_03. If so, release BX and try operation.




② RUN/STOP method is properly set ?

☞ Check FUN_01 RUN/STOP method setting matches the actual operation mode(RUN/STOP via keypad or terminal). If FUN_01 Is set to terminal but operation is not performed, change it to keypad mode and try operation. If FUN_02 is set to Keypad but operation is not performed, change it to Terminal and try operation. If either way cannot work, refer to (6).

**2) The motor does not rotate when Green lamp on [REV], [FWD] key is ON.**

① Is inverter U, V, W output correctly wired to motor U, V, W output?

☞ Refer to Main circuit terminal

② Is the motor shaft jammed by brake or other mechanical devices?

☞ check the directly connected brake's relay on time and brake open time.

③ On DIS_01 PreRamp Ref, is speed reference displayed not "0"?

☞ set the desired speed reference if it is set to "0". If it is incorrectly set, refer to (7).

④ Is PAR_07 [motor rating] properly set?

☞ check the motor nameplate and setting matches.

⑤ Is PAR_16 [motor speed] properly set?

☞ check the motor nameplate and setting matches.

⑥ Is PAR_22 [motor rated current] properly set?

☞ check the motor nameplate and setting matches.

⑦ Is PAR_26 [motor flux current] properly set?

☞ If LG-OTIS vector motor is not used, consult LS representative or set the correct value in accordance with application. However, it cannot set to exceed PAR_22 [motor rated current]. Normally it is 30~40 % of rated

motor current.

⑧ Is PAR_21 [motor rated slip] properly set?

☞ check the motor nameplate and setting matches.

⑨ Is PAR_27 [Motor secondary time constant (Tr) properly set?

☞ If motor is not LG-OTIS vector motor, perform the Auto-tuning or set this correctly. If it is incorrectly set, inverter performance will be dramatically deteriorated.

⑩ Is PAR_19 [number of motor poles] properly set?

☞ check the motor nameplate and setting matches.

⑪ CON_28 [Torque limit setting] is set to " Kpd Kpd Kpd ". Is CON_29 ~ CON_31 setting correct?

☞ CON_29 ~ CON_31 marks upper limit in inverter output torque. For the application lower torque limit is required, when torque shortage occurs, increase this value a little. STARVERT-iV5 's overload capacity is 150%/1 min. when using torque limit over 150%, time and the number of use should be limited.

⑫ When CON_28[torque limit setting] Analog or Option, the corresponding input value is properly set?

☞ CON_28 is set to Analog, one of Ai1/Ai2/Ai3 should be defined as "Torque limit". If set to Option, refer to Option manual for proper setting.

**3) Motor speed is not increasing while it is running.**

① Is PAR_10 [number of Encoder pulse] set properly?

☞ factory default is 1024. If it is not OTIS vector motor, contact with Encoder maker.

② FUN_01 is set to "Keypad",FUN_02 to "Keypad1", FUN_12(Speed 0) to 100.0rpm and press [FWD] key but motor speed is not 100.0rpm. In this case, check for encoder wiring.

☞ If encoder wiring is disconnected or switched, it rotates only uni-direction with low speed (30.0 ~ 60.0rpm) and over 150% its rated current. Check the encoder wiring and whether wiring of defined terminal and motor encoder terminal is shorted.

③ If motor speed does not increase and keeps abnormally 30.0 ~ 60.0 rpm, stop the motor and switch the wiring of A and B phase of Encoder. Check whether motor rotating direction is reversed as seen in (4).

☞ In the case of Line Drive type encoder, wire A+, A- phase to B+, B- and B+, B- phase to A+, A-. Complementary / for the case of Open Collector type encoder, reverse the wiring of PA and PB.

Or switch the encoder direction in **PAR 11 (Enc Dir Set) and try RUN.**

**4) Motor rotates in reverse direction.**

☞ Switch the wiring of output phase V and W. Switch the wiring of encoder phase A and B as indicated in (3).

**Or switch the encoder direction in PAR_11(Enc Dir Set) and try RUN.**

**5) Motor rotating direction cannot be changed.**

① Is RUN/STOP setting proper?

☞ Check FUN_01 RUN/STOP command setting matches the actual operating mode. If FUN_01 is set to Terminal (Keypad) but operation cannot be made, change it to Keypad (Terminal). If it does not work, refer to 6)

② Is one of the terminal defined as FWD/REV Run Disable ON?

☞ Check one of DIO_01 ~ DIO_07 terminals is defined as "Prohibit FWD" or "Prohibit REV". If so, check input terminal status in DIS_01 ~ DIS_03. If rotating direction is not changed, check the terminal is ON.

**6) Keypad or terminal malfunctions.**

① When [REV], [FWD], [STOP] key on the keypad is lit Red or Green

☞ Refer to 1) if RUN/STOP is not activated by Keypad or Terminal. If setting change is not available, PAR_04 may set to prohibit parameter write. To release this setting, enter 12 in PAR_04. If problem persists, contact LS representatives.

② When [STOP] key is blinking

☞ This marks trip condition or BX active status. Check any other trips occur in DIS_05. Reset the trip and try run. Check BX signal is ON on the keypad and input terminal signal in DIS_01 ~ DIS_03. Reset BX and try run.

③ When green lamp on [REV], [FWD] key is blinking

☞ It marks accel/decel is in operation. If inverter keeps operation in this condition, it means load capacity calculation is incorrect and exceeds inverter rating. Refer to (16).

**7) Operating speed does not change during run.**

① Is FUN_02 speed setting proper?

☞ Speed setting methods in STARVERT-iV5 are Analog input, Keypad and Option. Select appropriate one among them.

② Is DIS_01(PreRamp Ref) setting the correct value?

☞ Current speed ref. Values are displayed in DIS_01 ~ DIS_03. Check the displayed value matches the setting value. If speed is not variable, check the encoder. (Refer to (13))

③ Speed setting method is "Keypad" and speed ref displayed DIS_01 ~ DIS_03 is not correct.

☞ Check terminal setting in DIO_01 ~ DIO_07 defined as Multi-step speed setting.

④ When speed setting method is Analog and DIS_01 ~ DIS_03 display is not desired value

☞ Check one of Ai1 ~ Ai3 is defined as "Speed Ref.".

**8) Motor keeps rotating at 0V condition when speed setting is via Analog input.**

① When AIO_11 Definition of AI1 Input is set to "Speed Ref"

☞ Adjust the Ai1_Bias at AIO_14. (Setting unit: %)

The displayed value is speed command. Set the desired value (ex: 0.0%) and press [ENTER] key.

② Follow the same steps to check Ai2 ~ Ai3.

**9) Motor detects speed reference but motor rpm is showing decreasing while motor is overheated or hunting.**

① Check the motor wiring.

☞ There is a possibility of incorrect motor wiring when motor is 220V / 380V dual rating. Motor does not normally rotate when pole number setting is incorrect. However, motor may get damaged in case of miswiring. If this problem occurs, contact motor sales office. Refer to Power terminal description in this manual.

② Is motor capacity set correctly?

☞ Check PAR_07 motor rating selection is set the same as motor in use. See the nameplate for motor rating.

③ Is motor parameter set correctly?

☞ Motor parameters vary by manufacturer. STARVERT-iV5 setting is based on OTIS vector motor as default. Motor parameters should be changed when other makers' motor is used.

**10) Nothing displayed on the LCD?**

① Is the connection of inverter and keypad tight?

☞ Check the inverter and Keypad connection.

② Is input power turned on ?

☞ Check inverter power is applied. If nothing is displayed on the LCD in this condition, contact LS representatives.

**11) Motor speed oscillates and speed is not constant during constant Run.**

① Is encoder wired using twisted shield cable?

☞ encoder signal wiring should be conducted with Twisted Shield Cable. Otherwise, speed may oscillate at low speed (or high speed) due to encoder input noise, leading to motor vibration or abnormal motor sound at stop.

② Is the connection of inverter and motor and encoder grounding proper?

☞ Check the grounding of inverter and encoder is connected. This could occur when not connected. Fixed screw for the connection of encoder grounding and the inverter is located on the right bottom side of the control PCB. Loosen the fixed screw and insert the ground wire of the encoder and tighten the screw. (Refer to encoder wiring diagram). For grounding the motor, use G of the inverter Main terminal.

③ Connect inverter panel grounding connected with motor grounding to the building grounding.

☞ If not, incorrect motor speed may be input due to encoder input noise.

④ Is too large speed gain assigned to the inverter while motor load is light?

☞ Motor oscillates at stop when PI gain is set much larger than the actual load in CON_03 and CON_04.

Therefore, gain should be set accordingly. Responsiveness increases when P gain is set higher and I lower but system may become unstable. Gain value varies system but generally set **30 ~ 70%** for **P gain** and set **100 ~ 500ms** for **I gain.**

⑤ Increase PAR_13 Enc LPF setting value.

⑥ Is there slip present at the connection of encoder and motor shaft?

☞ Poor encoder and motor connection may generate slip. Check the connection is tight.

**12) Parameter change is not saved.**

☞ Turn the power off and turn it on. If problem persists, contact LS representatives.

**13) "Fuse Open" trip occurs constantly.**

① is the input (line) voltage normal?

☞ Check the line voltage input. If phase to phase unbalance exceeds 2%(greater than 6V for 380V input), an AC reactor should be provided. Otherwise, inverter may get damaged and A/S fee will be charged during Warranty period.

② is the phase sequence of the output terminal U, V, W correct?

☞ Check the level of the input signal.

③ Is the motor insulation damaged?

☞ Various types of malfunction occur when the insulation is damaged. In general, operation stops at a certain speed (and more), overload or "OC-U (V,W)" trip occurs during regenerating. Or motor overheating and rotating speed oscillates. This condition persists for a while and then "Fuse Open" trip occurs. It marks motor insulation is damaged. In this case, replace the motor.

**14) Motor input current is too large.**

① Check the motor wiring.

☞ Check the motor wiring for the use of 220V / 380V transition type motor. (Refer to Main circuit terminal)

② Are motor and inverter capacity set correctly?

③ Is the setting of motor constants appropriate?

☞ Refer to 2) and 9) and check the motor and inverter setting.

**15) OC-U (V,W) trip occurs frequently during operation. (Motor input current is oscillating.)**

① check the encoder installation.

☞ If encoder connection is poor, motor vibration affects encoder and incorrect encoder signal is input to the Inverter. Vector inverter controls the speed from Encoder F/B value so it follows the input signal whether correct or not, increasing inverter current. If so, contact motor maker or encoder commission company.

② Is there no inverter output phase loss?

③ Is the motor insulation not damaged?

☞ Refer to 13) and check the inverter and motor.

**16) Accel/Decel cannot be made properly and green lamp in [REV], [FWD] key is blinking.**

**(load and frequency reference signal is oscillating.)**

① Check motor wiring.

② FUN_40 ~ FUN_47 Accel/Decel time and DIS_00 motor load.

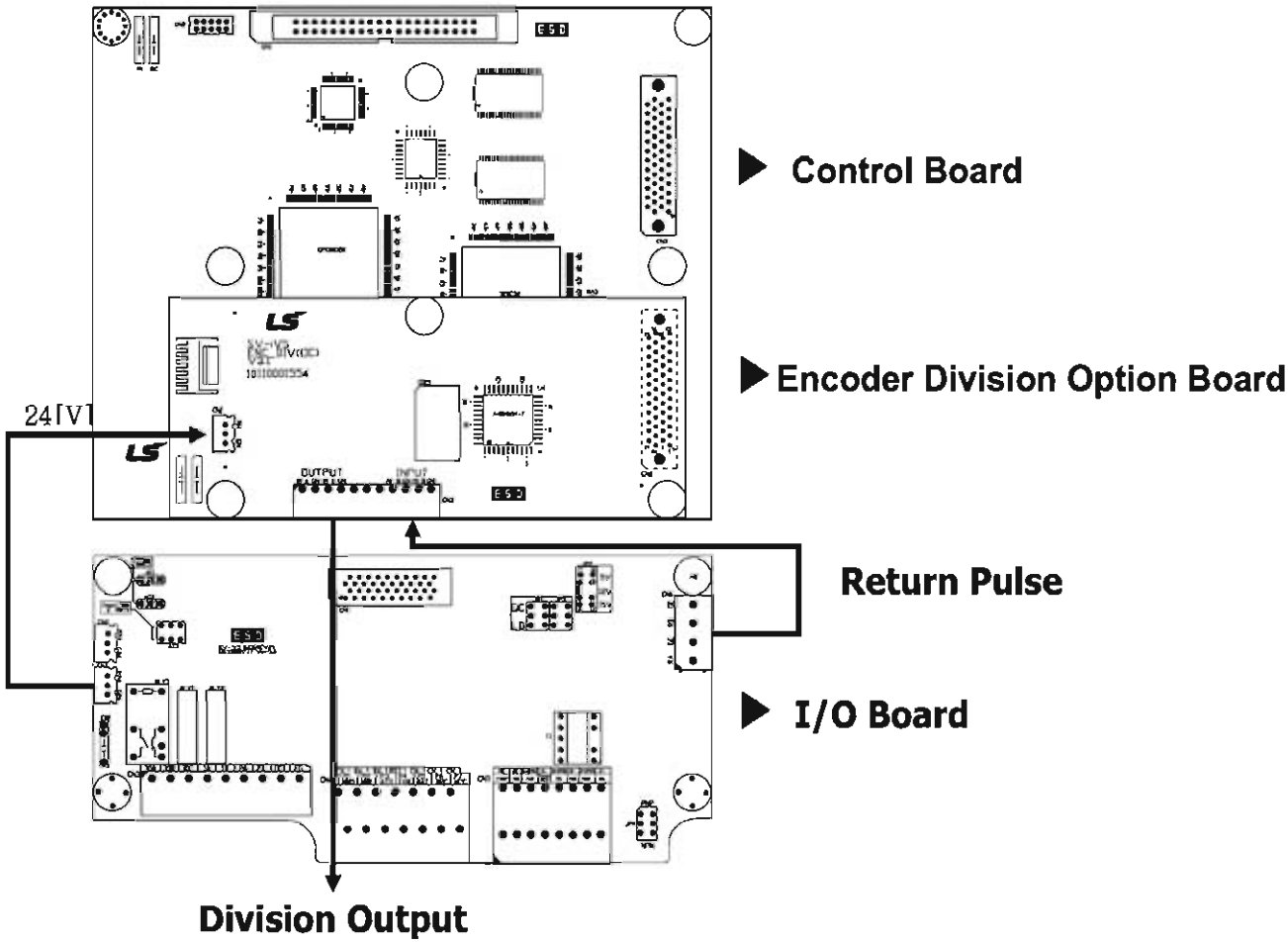
☞ Blinking Green lamp marks motor is accelerating or decelerating. If the rotating speed oscillates and green lamp is blinking, it marks inverter output torque shortage due to mis-calculation of load. In this case, increase the torque limit to enable inverter to accelerate/decelerate within its rating. If load is set too high, it will shorten inverter life or damage to the unit.

# Chapter 10 - Option Devices

## 10.1 Encoder Division Option Board

### 10.1.1 Encoder division option board installation and WIRING guide.

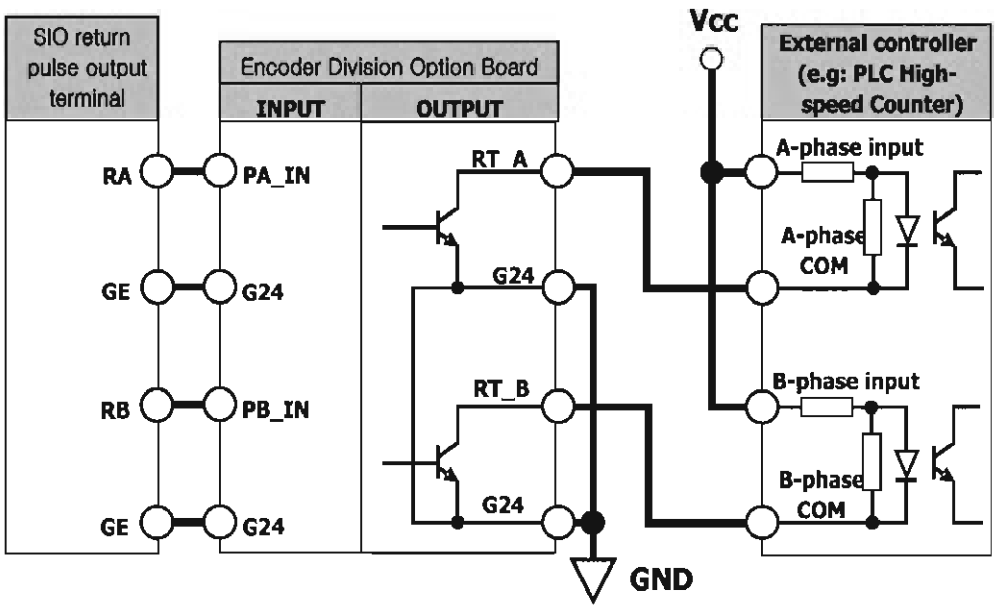
- Connect the option card's CN2 connector to CN4 on the control board.



### 10.1.2 Wiring guide for encoder division option board

-. Connect Encoder output terminal (Open collector output) on I/O board to input terminal of the option card.

| Encoder Division Option Board Terminal name | | Encoder Division Option Board Description | Connection board and terminal |
|---|---|---|---|
| Input | PA_IN | Encoder Phase A Division Input | I/O Board: RA (Phase A Output) |
| | PB_IN | Encoder Phase B Division Input | I/O Board: RB (Phase B Output) |
| | G24 | GND | I/O Board: GE (GND) |
| Output | RT_A | Encoder Phase A Division Input | External controller: Phase A Input |
| | RT_B | Encoder Phase B Division Input | External controller: Phase B Input |
| | G24 | GND | External controller: GND |




**Warning**

Wiring must be considered with input circuit . Because encoder output is open collector type. The figure is shown the wiring when inverter is connected with High-speed counter of LSIS PLC.

### 10.1.3 Encoder division output

Only available when Encoder Division Output Option Card is installed.

Sets the division ratio for monitoring the Encoder pulse signals.

| Code | Address | LCD display | Description | Setting range | Unit | Factory setting |
|---|---|---|---|---|---|---|
| PAR_31 | 731F | EncDiv Ratio | Encoder Pulse Output Division Rate | 1 ~ 1128 | | 1 |
| PAR_32 | 7320 | EncDivFilter | Encoder Division Output Filter | 0 ~ 15 | | 0 |

Encoder division output option card outputs one pulse signal when input pulse number matches the value set in PAR_31. A/B pulse output follows input pulse phase. The relationship between output of A, B pulse follows the same as input pulse. Division ration can be set within the range of 1 (1 output pulse per 1 input pulse) ~ 1/128(1 output pulse to 128 input pulse).

PAR_31 setting range: 0001 ~ 1128. Division ratio cannot be set higher than 1 and only 1 or 2 can be set for numerator. The below is Division ratio calculation formula.

N refers to the value from thousand (**0**000) and M refers to value less than thousand (0**000**)

PAR_31 set value = N×1000 + M.

Division ratio = (1+N)/M

Setting range: N (0, 1), M (1 ~ 128)

PAR_31 = □ □□□

N M

When PAR_31 setting value is below 1000 (N=0), a numerator value becomes 1 and when above 1000 (N=1), a numerator value becomes 2. For example, if PAR_31 is set to 15, the division ratio is 1/15 and if 1015, the ratio is 2/15. Division ratio is settable up to 1/128 and greater than 1 is not settable. Using Up key on the keypad PAR_31 value is increased and increase routine is 1 → 2 → 3 → 4 → ... → 127 → 128(Division ratio: 1/128) → 1002 (Division ratio: 1) → 1003 → ... → 1128 (Division ratio: 1/64) and decrease routine (using Down key on the keypad) is the same as increase routine.

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# Chapter 11 - Accessories

## 11.1 MCCB(LS), ELB(LS), Magnetic Contactor(LS), input/output Wire specifications

| Voltage | Motor (kW) | Inverter models | MCCB, ELB (LS) | Magnetic contactor (LS) |
|---|---|---|---|---|
| 200V | 2.2 | SV022iV5-2DB | ABS33b,EBS33b | GMC-18 |
| | 3.7 | SV037iV5-2DB | ABS33b,EBS33b | GMC-22 |
| | 5.5 | SV055iV5-2DB | ABS53b,EBS53b | GMC-32 |
| | 7.5 | SV075iV5-2DB | ABS63b,EBS63b | GMC-40 |
| | 11 | SV110iV5-2DB | ABS103b,EBS103b | GMC-50 |
| | 15 | SV150iV5-2DB | ABS103b,EBS103b | GMC-65 |
| | 18.5 | SV185iV5-2DB | ABS203b,EBS203b | GMC-80 |
| | 22 | SV220iV5-2DB | ABS203b,EBS203b | GMC-100 |
| | 30 | SV300iV5-2 | ABS203b,EBS203b | GMC-150 |
| | 37 | SV370iV5-2 | ABS203b,EBS203b | GMC-180 |
| 400V | 2.2 | SV022iV5-4DB | ABS33b,EBS33b | GMC-22 |
| | 3.7 | SV037iV5-4DB | ABS33b,EBS33b | GMC-22 |
| | 5.5 | SV055iV5-4DB | ABS33b,EBS33b | GMC-22 |
| | 7.5 | SV075iV5-4DB | ABS33b,EBS33b | GMC-22 |
| | 11 | SV110iV5-4DB | ABS53b,EBS53b | GMC-22 |
| | 15 | SV150iV5-4DB | ABS63b,EBS63b | GMC-32 |
| | 18.5 | SV185iV5-4DB | ABS103b,EBS103b | GMC-40 |
| | 22 | SV220iV5-4DB | ABS103b,EBS103b | GMC-50 |
| | 30 | SV300iV5-4(380V) | ABS203b,EBS203b | GMC-85 |
| | 37 | SV370iV5-4(380V) | ABS203b,EBS203b | GMC-100 |
| | 45 | SV450iV5-4(380V) | ABS203b,EBS203b | GMC-125 |
| | 55 | SV550iV5-4(380V) | ABS203b,EBS203b | GMC-150 |
| | 75 | SV750iV5-4(380V) | ABS203b,EBS203b | GMC-180 |
| | 90 | SV900iV5-4(380V) | ABS403b,EBS403b | GMC-220 |
| | 110 | SV1100iV5-4(380V) | ABS403b,EBS403b | GMC-300 |
| | 132 | SV1320iV5-4(380V) | ABS403b,EBS403b | GMC-400 |
| | 160 | SV1600iV5-4(380V) | ABS403b,EBS403b | GMC-400 |
| | 220 | SV2200iV5-4(380V) | ABS603b,EBS603b | GMC-600 |
| | 280 | SV2800iV5-4 | ABS1003/1000A | GMC-800 |
| | 315 | SV3150iV5-4 | ABS1203/1200A | 900A |
| | 375 | SV3750iV5-4 | ABS1203/1200A | 1000A |

## 11.2 AC input fuse, AC reactor, DC reactor

| Voltage | Motor (kW) | Inverter models | AC input fuse | AC reactor | DC reactor |
|---|---|---|---|---|---|
| 200V | 2.2 | SV022iV5-2DB | 25 A | 0.88 mH, 14 A | – |
| | 3.7 | SV037iV5-2DB | 40 A | 0.56 mH, 20 A | – |
| | 5.5 | SV055iV5-2DB | 40 A | 0.39 mH, 30 A | – |
| | 7.5 | SV075iV5-2DB | 50 A | 0.28 mH, 40 A | – |
| | 11 | SV110iV5-2DB | 70 A | 0.20 mH, 59 A | – |
| | 15 | SV150iV5-2DB | 100 A | 0.15 mH, 75 A | – |
| | 18.5 | SV185iV5-2DB | 100 A | 0.12 mH, 96 A | – |
| | 22 | SV220iV5-2DB | 125 A | 0.10 mH, 112 A | – |
| | 30 | SV300iV5-2 | 150A | 0.08 mH, 134 A | 0.35 mH, 152 A |
| | 37 | SV370iV5-2 | 200A | 0.07 mH, 160 A | 0.30 mH, 180 A |
| 400V | 2.2 | SV022iV5-4DB | 10 A | 3.23 mH, 7.5 A | – |
| | 3.7 | SV037iV5-4DB | 20 A | 2.34 mH, 10 A | – |
| | 5.5 | SV055iV5-4DB | 20 A | 1.22 mH, 15 A | – |
| | 7.5 | SV075iV5-4DB | 30 A | 1.14 mH, 20 A | – |
| | 11 | SV110iV5-4DB | 35 A | 0.81 mH, 30 A | – |
| | 15 | SV150iV5-4DB | 45 A | 0.61 mH, 38 A | – |
| | 18.5 | SV185iV5-4DB | 60 A | 0.45 mH, 50 A | – |
| | 22 | SV220iV5-4DB | 70 A | 0.39 mH, 58 A | – |
| | 30 | SV300iV5-4(380V) | 100 A | 0.33 mH, 67 A | 1.19 mH, 76 A |
| | 37 | SV370iV5-4(380V) | 100 A | 0.27 mH, 82 A | 0.98 mH, 93 A |
| | 45 | SV450iV5-4(380V) | 100 A | 0.22 mH, 100 A | 0.89 mH, 112 A |
| | 55 | SV550iV5-4(380V) | 150 A | 0.15 mH, 121 A | 0.75 mH, 135 A |
| | 75 | SV750iV5-4(380V) | 200 A | 0.13 mH, 167 A | 0.44 mH, 187 A |
| | 90 | SV900iV5-4(380V) | 250 A | 0.11 mH, 201 A | 0.35 mH, 225 A |
| | 110 | SV1100iV5-4(380V) | 300 A | 0.09 mH, 245 A | 0.30 mH, 274 A |
| | 132 | SV1320iV5-4(380V) | 400 A | 0.08 mH, 290 A | 0.26 mH, 324 A |
| | 160 | SV1600iV5-4(380V) | 400 A | 0.06 mH, 357 A | 0.22 mH, 399 A |
| | 220 | SV2200iV5-4(380V) | 800A | 0.029mH, 799 A | 0.1mH, 530 A |
| | 280 | SV2800iV5-4 | 900A | 0.029mH, 799 A | 0.090mH, 836 A |
| | 315 | SV3150iV5-4 | 1000A | 0.024mH, 952 A | 0.076mH, 996 A |
| | 375 | SV3750iV5-4 | 1200A | 0.024mH, 952 A | 0.064mH, 1195 A |

※ For 2.2~22kW, DC reactor standard is not provided, for not having DC reactor wiring terminal.

## 11.3 The Selection of Braking Resistor and the Unit

### 11.3.1 The selection of dynamic braking resistor

Resistor values shown in the following table is calculated on the basis of 150% of rated braking torque, 5% ED 1). Power rating of resistor should be doubled for resistor frequency 10% ED use. Additional braking unit should be installed for above SV 300iV5-2 / SV300iV5-4.

| Inverter | Rated Capacity (5% ED) | |
|---|---|---|
| | [Ω] | [W](2) |
| SV 022iV5-2 DB | 50 | 400 |
| SV 037iV5-2 DB | 33 | 600 |
| SV 055iV5-2 DB | 20 | 800 |
| SV 075iV5-2 DB | 15 | 1200 |
| SV 110iV5-2 DB | 10 | 2400 |
| SV 150iV5-2 DB | 8 | 2400 |
| SV 185iV5-2 DB | 5 | 3600 |
| SV 220iV5-2 DB | 5 | 3600 |
| SV 022iV5-4 DB | 200 | 400 |
| SV 037iV5-4 DB | 130 | 600 |
| SV 055iV5-4 DB | 85 | 800 |
| SV 075iV5-4 DB | 60 | 1200 |
| SV 110iV5-4 DB | 40 | 2400 |
| SV 150iV5-4 DB | 30 | 2400 |
| SV 185iV5-4 DB | 20 | 3600 |
| SV 220iV5-4 DB | 20 | 3600 |

✓ **(1): ED is based on 100 seconds.**

✓ **(2): Rated capacity is based on the self-cooling.**

### 11.3.2 Wiring of the temperature sensor on braking resistor

Temperature sensor is attached in the LSIS braking resistors to prevent the fire.

| Terminal of Braking Resistor | Power Terminal of Inverter | Action |
|---|---|---|
| B1, B2 | P, BR | |
| P7, CM | One of the multi-function input terminals (P1 ~ P7) should be set to 'External Fault Signal b Contact'. | Contact is normally ON at the ambient temperature and is OFF in case of over-temperature. |

### 11.3.3 Braking unit

① SV037DBH-2: 37kW/200V Class Braking Unit (10% ED)

② SV037DBH-4: 37kW/400V Class Braking Unit (10% ED)

③ SV075DBH-4: 75kW/400V Class Braking Unit (10% ED)

④ SV075DB-4 : 75kW/400V Class Braking Unit (100% ED)

⑤ SV220DB-4 : 220kW/400V Class Braking Unit (100% ED)

- The Combination of two braking unit for 400V class is possible for more than SV900iV5-4 capacity.
- When ED is more than 10%, Use the braking unit for 100% ED (Ex: vertical load such as carne, hoist)
- When the inverter capacity is more than 220kW, use the braking unit for SV2200DB-4 (100% ED).
- Refer to description manual included in braking unit product for the use of 100% ED braking unit.

### 11.3.4 Combination of braking unit

| Inverter / Braking unit | | SV[][][] iV5-2 | SV[][][][]iV5-4 | | | | |
|---|---|---|---|---|---|---|---|
| | | 300/370 | 300/370 | 450/550/750 | 900/1100/1320/1600 | 2200 | 2800/3150/3750 |
| 200V | 37kW | 1 | | | | | |
| 400V | 37kW | | 1 | | | | |
| | 75kW | | | 1 | 2 | | |
| | 220kW | | | | | 1 | 2 |

Note)

1. Example) Combine two braking units of 75kW-400V Class for SV-900iV5-4(90kW) Class.
2. Refer to the Braking Unit user manual that came with the braking unit.

### 11.3.5 Braking resistor for braking unit

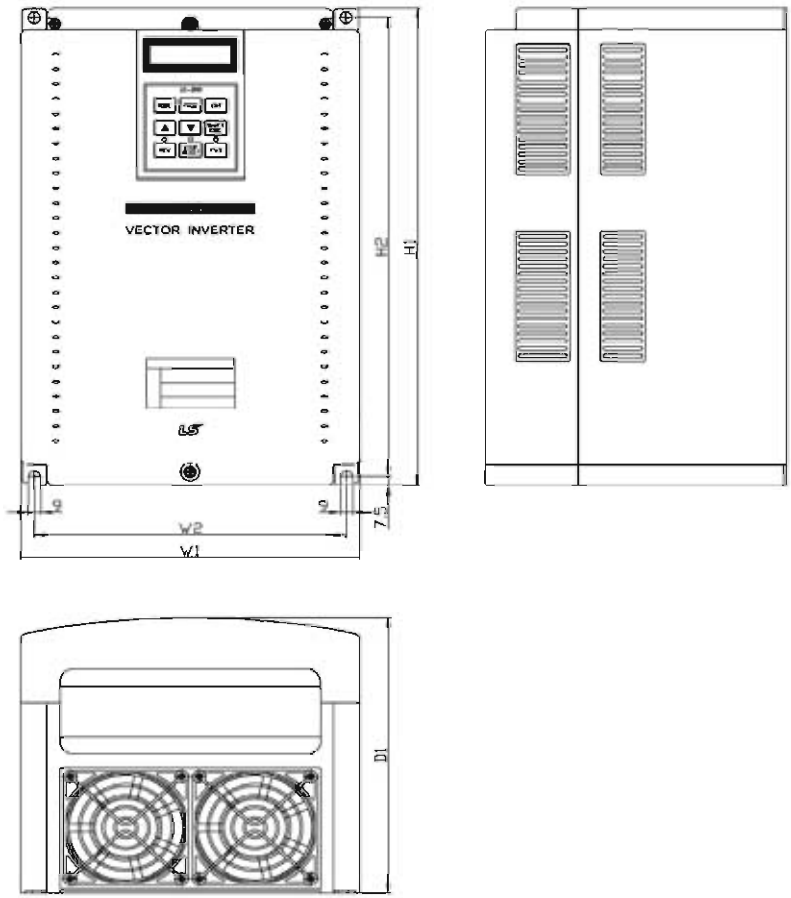
| Braking Unit | 100% of Braking Torque, 10% ED | |
|---|---|---|
| | Resistance [Ω] | Rated Power [kW] |
| 37kW-200V | 4 | 11.1 |
| 37kW-400V | 16 | 11 |
| 75kW-400V | 8 | 22.5 |
| 75kW-400V | 6 | Refer to extra manual in the case of 100% ED braking unit. |
| 220kW-400V | 2 | |

MEMO

# Chapter 12 - Dimensions

- SV 022, 037, 055, 075, 110, 150, 185, 220iV5-2DB(MD)
- SV 022, 037, 055, 075, 110, 150, 185, 220iV5-4DB(MD)

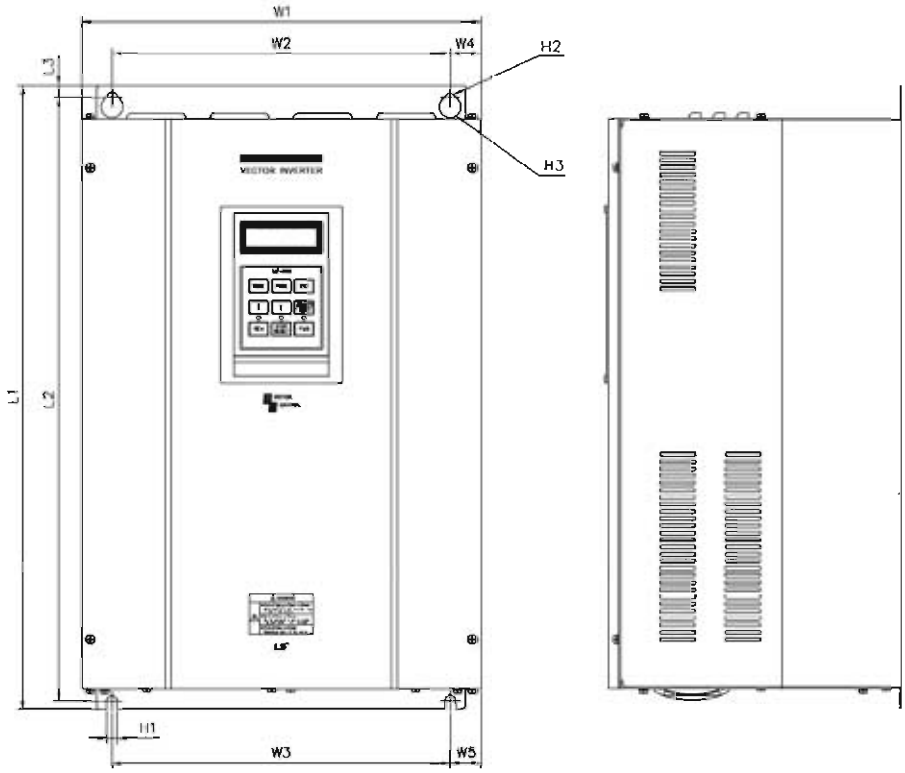
*MD: Mold type

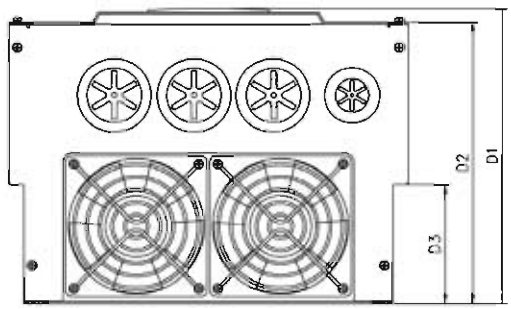



- **Dimensions (unit: mm [inches])**

| Models | W1 | W2 | H1 | H2 | D1 |
|---|---|---|---|---|---|
| SV022iV5-2/4DB(MD) | | | 284 | 269 | 207 |
| SV037iV5-2/4DB(MD) | 200 | 180 | [11.18] | [10.69] | [8.15] |
| SV055iV5-2/4DB(MD) | [7.87] | [7.09] | 355 | 340 | 202 |
| SV075iV5-2/4DB(MD) | | | [13.97] | [13.38] | [7.95] |
| SV110iV5-2/4DB(MD) | 250 | 230 | 385 | 370 | 221 |
| SV150iV5-2/4DB(MD) | [9.84] | [9.06] | [15.16] | [14.57] | [8.70] |
| SV185iV5-2/4DB(MD) | 304 | 284 | 460 | 445 | 254 |
| SV220iV5-2/4DB(MD) | [11.97] | [11.18] | [18.11] | [17.52] | [10.00] |

- **SV055, 075, 110, 150, 185, 220iV5-2(DB)**
- **SV055, 075, 110, 150, 185, 220iV5-4(DB)**

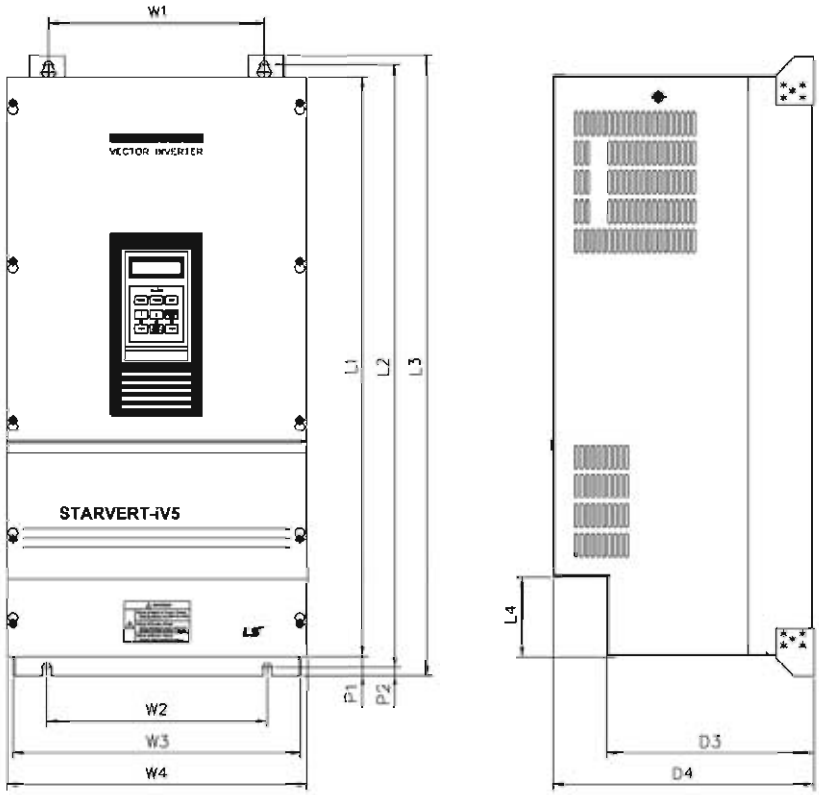


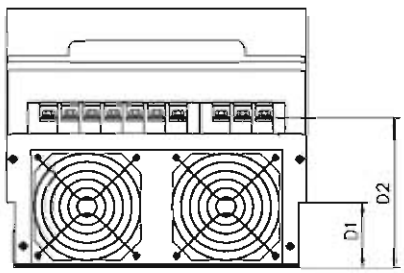




- **Dimensions (unit: mm [inches])**

| Models | W1 | W2 | W3 | W4 | W5 | L1 | L2 | L3 | D1 | D2 | D3 | H1 | H2 | H3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SV055iV5-2/4DB**<br>**SV075iV5-2/4DB** | 234.4<br>[9.22] | 180<br>[7.08] | 180<br>[7.08] | 27.2<br>[1.07] | 27.2<br>[1.07] | 406.2<br>[15.9] | 391.2<br>[15.4] | 7.5<br>[0.29] | 221.1<br>[8.7] | 209.5<br>[8.24] | 75<br>[2.95] | 6<br>[0.23] | Φ6 | Φ12 |
| **SV110iV5-2/4DB**<br>**SV150iV5-2/4DB**<br>**SV185iV5-2/4DB**<br>**SV220iV5-2/4DB** | 335<br>[13.1] | 284<br>[11.1] | 284<br>[11.1] | 25.5<br>[1.00] | 25.5<br>[1.00] | 526<br>[20.7] | 509<br>[20.0] | 10<br>[0.39] | 248.6<br>[9.78] | 237<br>[9.33] | 100<br>[3.93] | 7<br>[0.27] | Φ7 | Φ14 |

- **SV300, 370iV5-2**
- **SV300, 370, 450, 550, 750iV5-4**

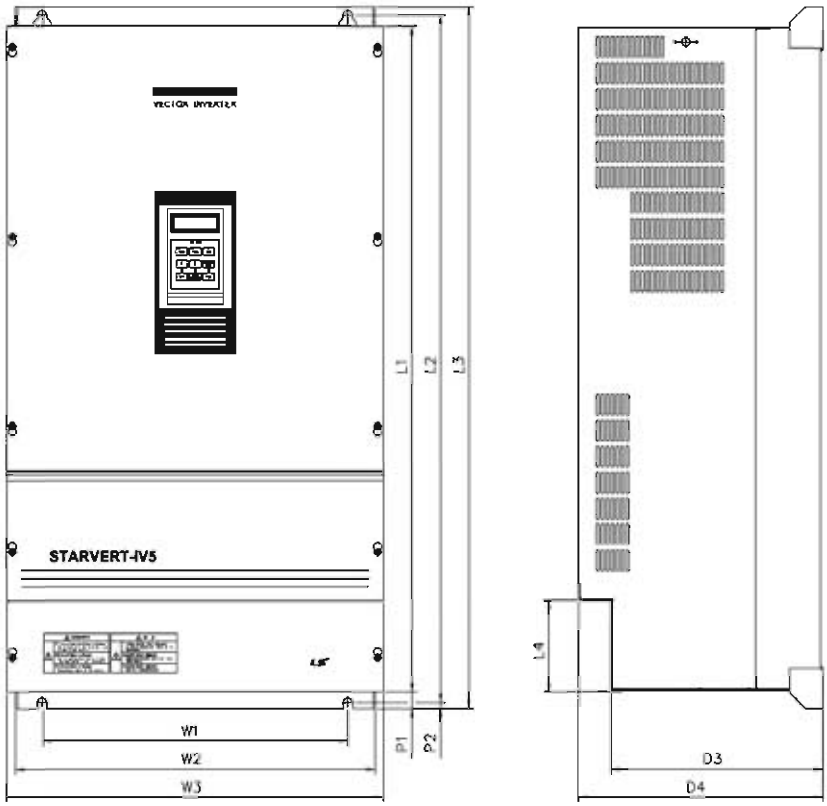


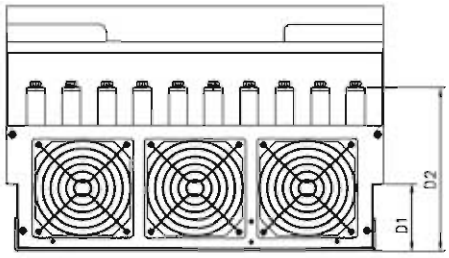




- **Dimensions (unit: mm [inches])**

| Models | W1 | W2 | W3 | W4 | L1 | L2 | L3 | D1 | D2 | D3 | D4 | P1 | P2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SV300iV5-2/4<br>SV370iV5-2/4 | 270<br>[10.6] | 270<br>[10.6] | 319.2<br>[12.5] | 350<br>[13.7] | 635<br>[25.0] | 660<br>[26.0] | 680<br>[26.7] | 120<br>[4.72] | 197<br>[7.76] | 256.6<br>[10.1] | 308.2<br>[12.1] | 16.9<br>[0.66] | 8<br>[0.31] |
| SV450iV5-4<br>SV550iV5-4<br>SV750iV5-4 | 275<br>[10.8] | 275<br>[10.8] | 359.6<br>[14.1] | 375<br>[14.7] | 730.6<br>[28.7] | 758.5<br>[29.8] | 780<br>[30.7] | 82.3<br>[3.24] | 189.3<br>[7.45] | 259<br>[10.2] | 326<br>[12.8] | 24.5<br>[0.90] | 10.5<br>[0.41] |

## ■ SV900, 1100, 1320, 1600iV5-4

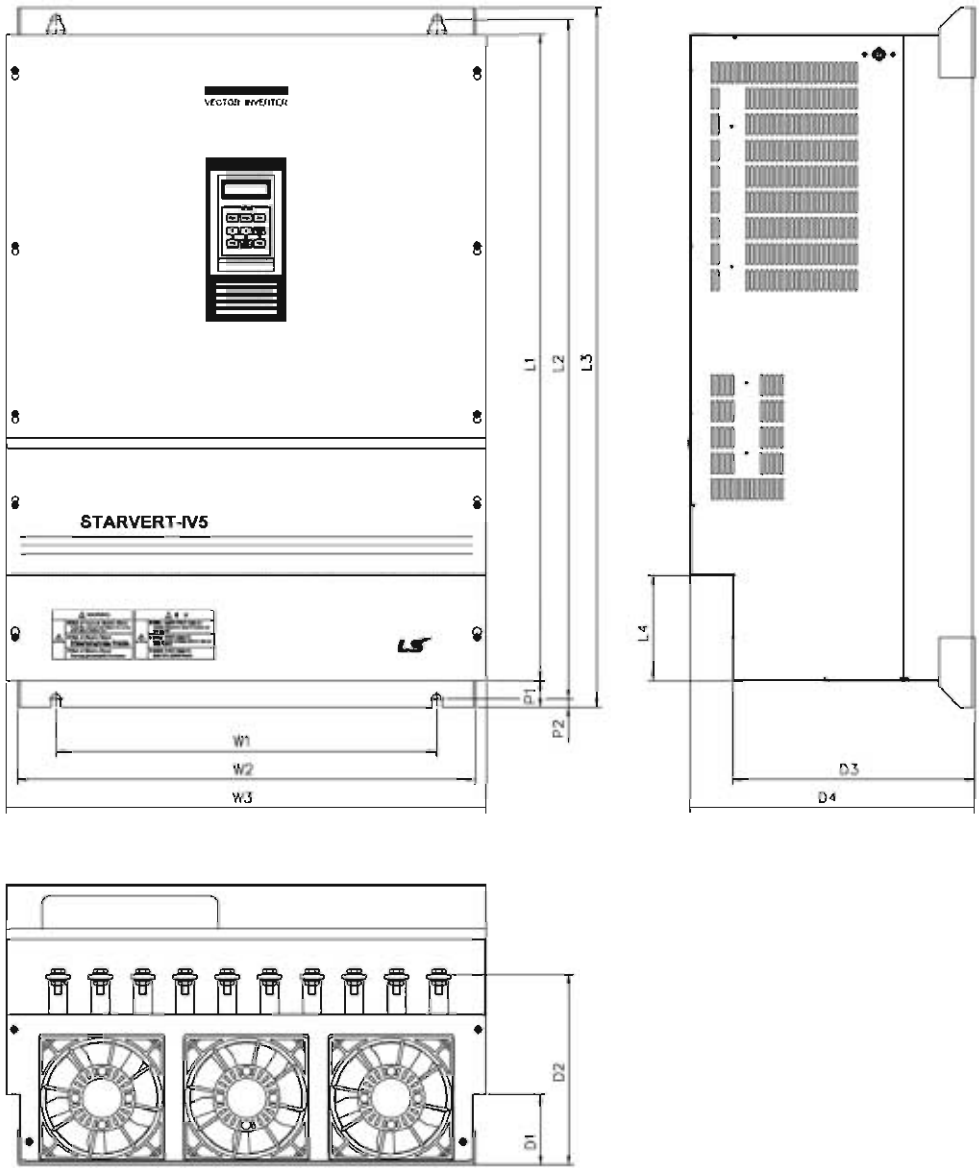



- **Dimensions (unit : mm[inches])**

| Models | W1 | W2 | W3 | L1 | L2 | L3 | D1 | D2 | D3 | D4 | P1 | P2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SV900iV5-4 | 430 | 507 | 530 | 729 | 760 | 780 | 83.2 | 234.6 | 286.2 | 335 | 23.5 | 8.5 |
| SV1100iV5-4 | [16.9] | [19.9] | [20.8] | [28.7] | [29.9] | [30.7] | [3.27] | [9.23] | [11.2] | [13.2] | [0.92] | [0.33] |
| SV1320iV5-4 | 430 | 507 | 530 | 949 | 980 | 1000 | 95.2 | 231.6 | 298 | 345 | 23.5 | 8.5 |
| SV1600iV5-4 | [16.9] | [19.9] | [20.8] | [37.3] | [38.5] | [39.3] | [3.75] | [9.12] | [11.7] | [13.5] | [0.92] | [0.33] |

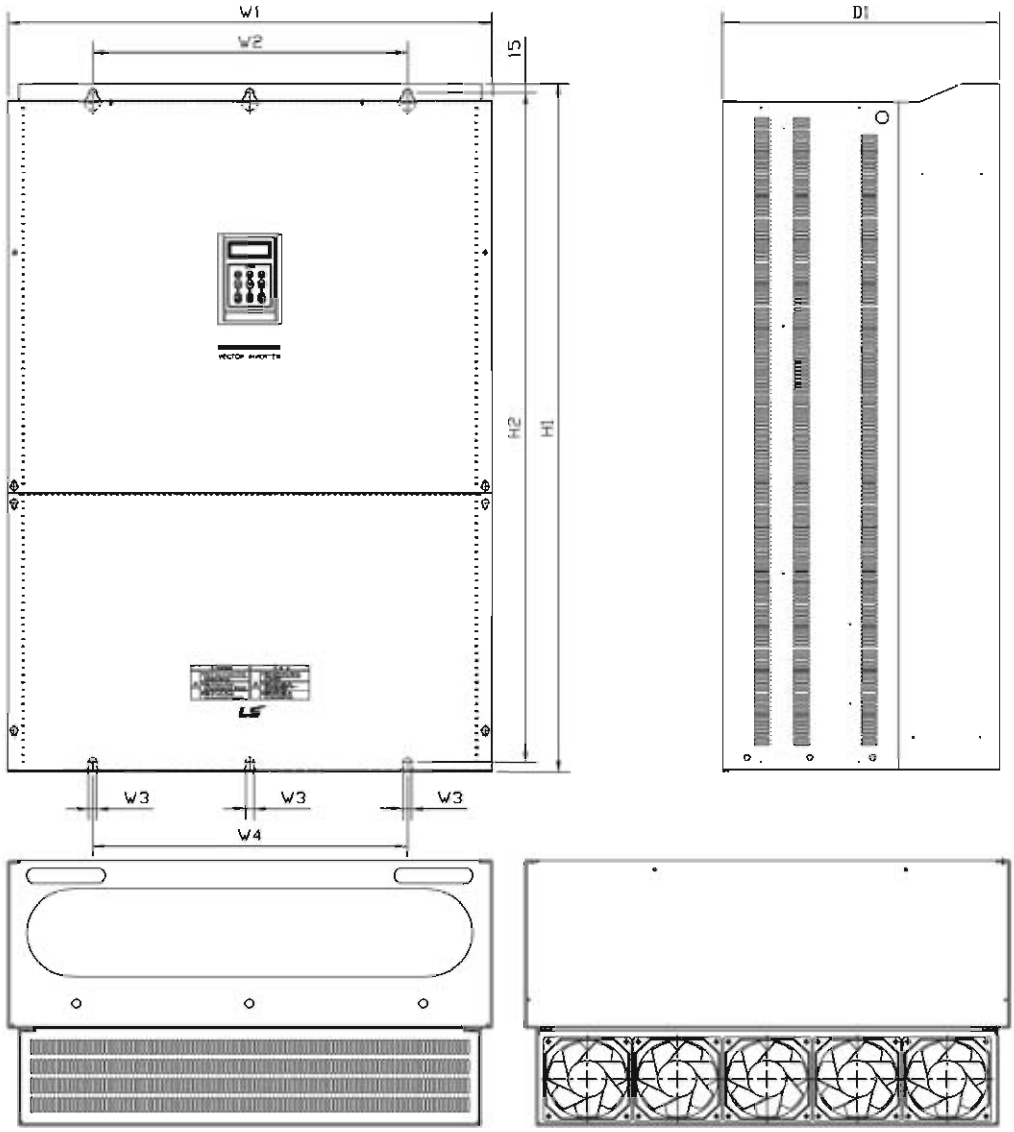
## ■ SV2200iV5-4




● **Dimensions (unit : mm[inches])**

| Models | W1 | W2 | W3 | L1 | L2 | L3 | L4 | D1 | D2 | D3 | D4 | P1 | P2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SV2200iV5-4 | 540 [21.26] | 649 [25.55] | 680 [26.77] | 922 [36.3] | 968.5 [38.13] | 998 [39.29] | 150 [5.91] | 100.2 [3.94] | 271 [10.67] | 343 [13.5] | 403 [15.87] | 38 [1.49] | 12 [0.47] |

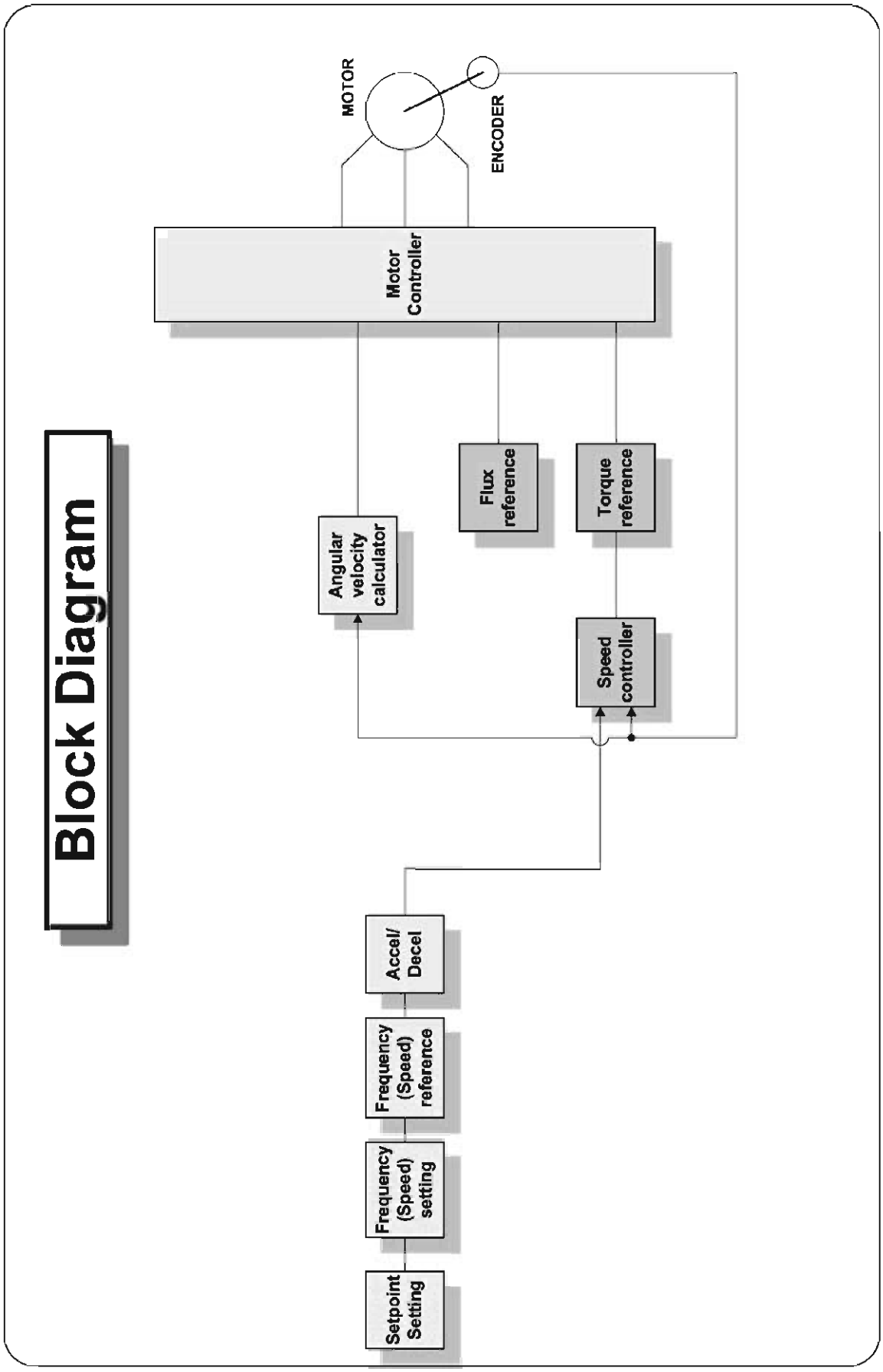
## ■ SV2800, 3150, 3750iV5-4

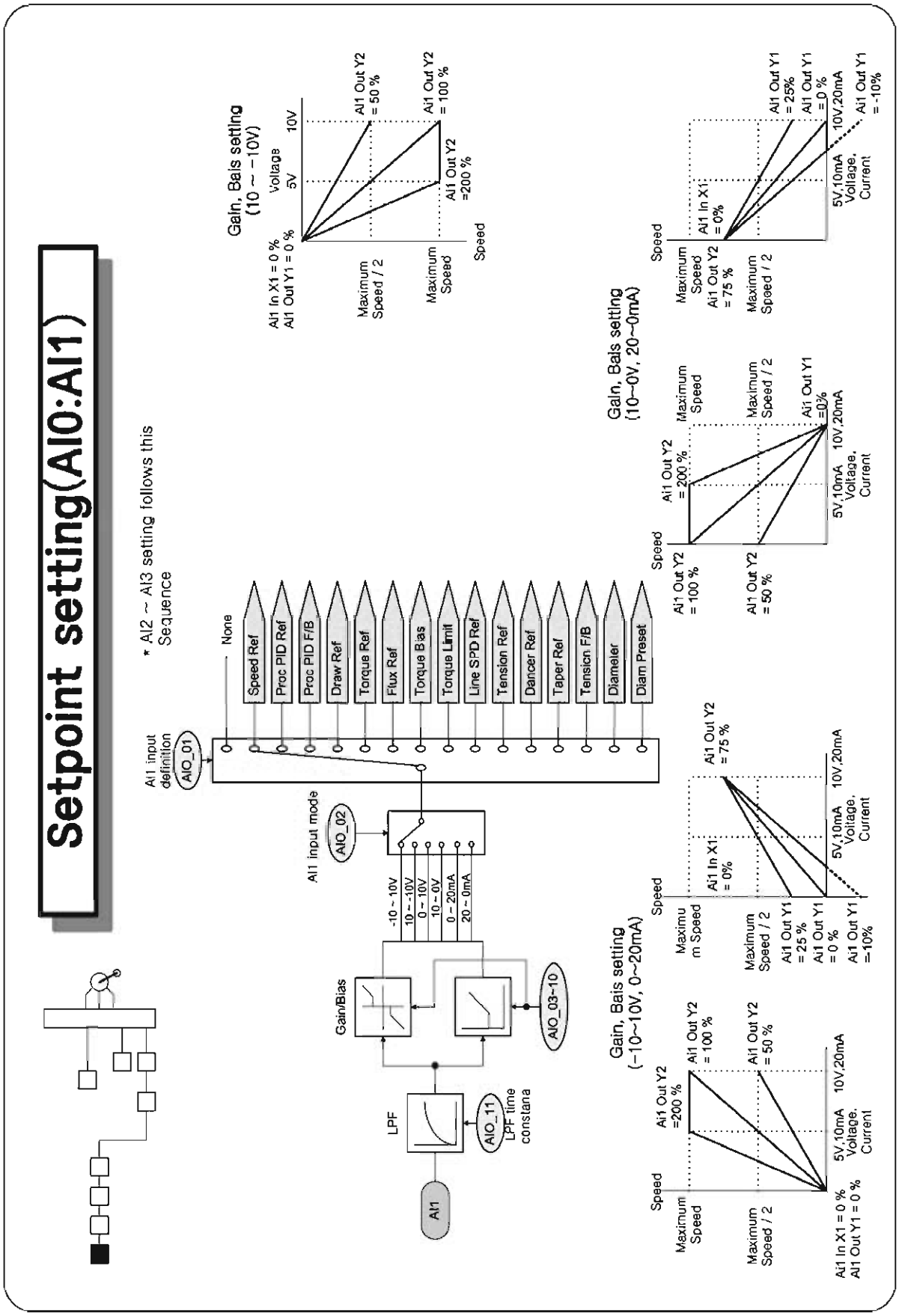


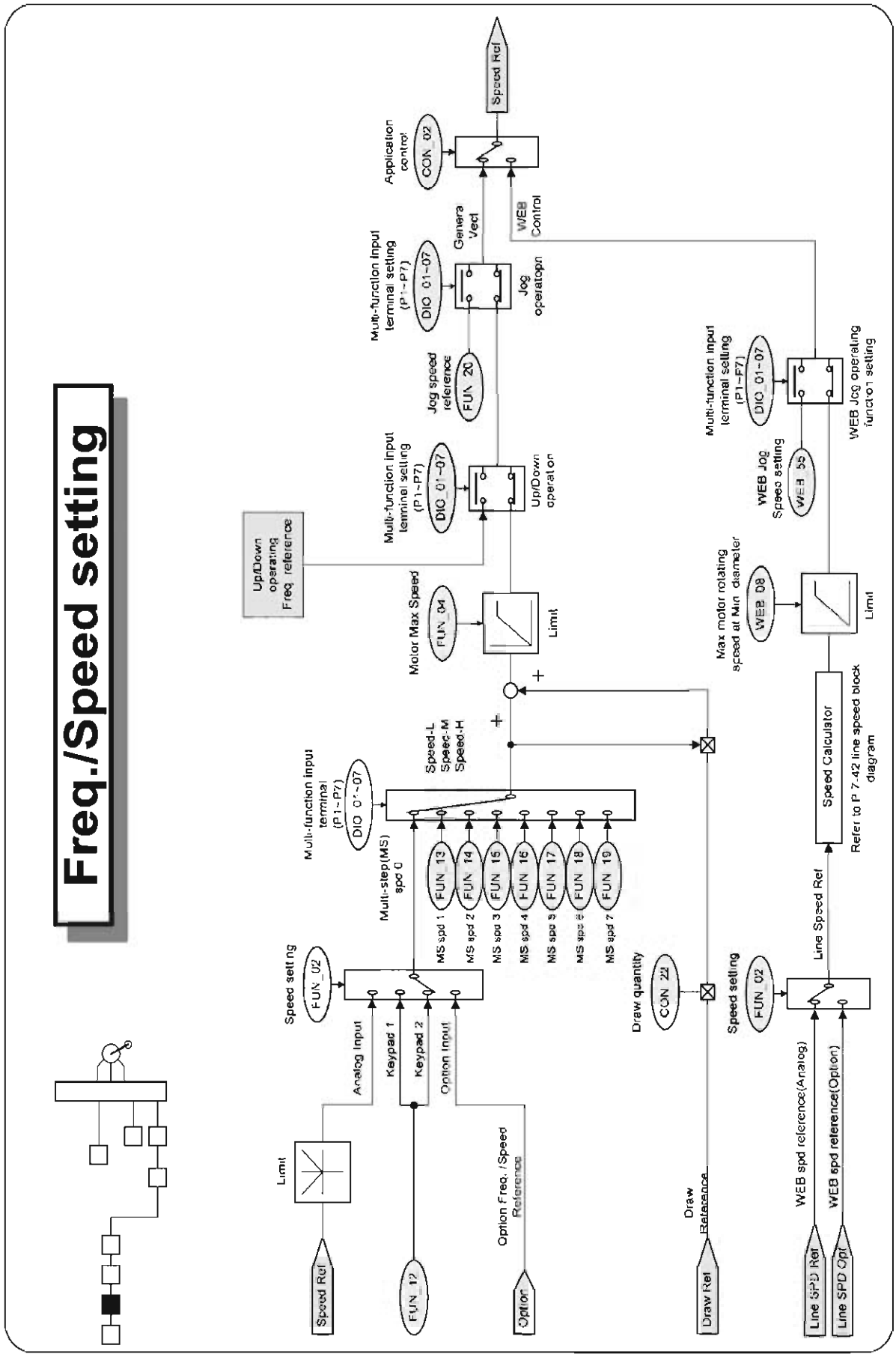

● **Dimensions (unit : mm[inches])**

| Models | W1 | W2 | W3 | W4 | H1 | H2 | D1 |
|---|---|---|---|---|---|---|---|
| SV2800iV5-4 | 772 [30.39] | 500 [19.69] | 13 [0.51] | 500 [19.69] | 1140.5 [44.90] | 1110 [43.70] | 442 [17.40] |
| SV3150iV5-4 SV3750iV5-4 | 922 [6.30] | 580 [22.83] | 14 [0.55] | 580 [22.83] | 1302.5 [51.28] | 1271.5 [50.06] | 495 [19.49] |

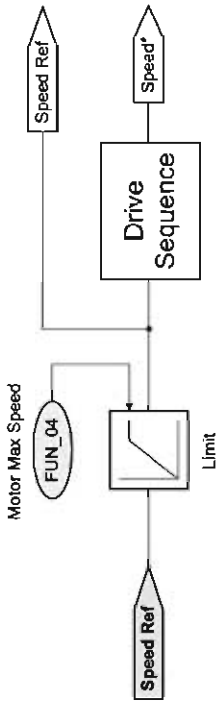
# Block Diagram

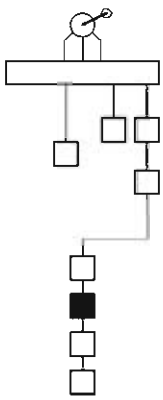


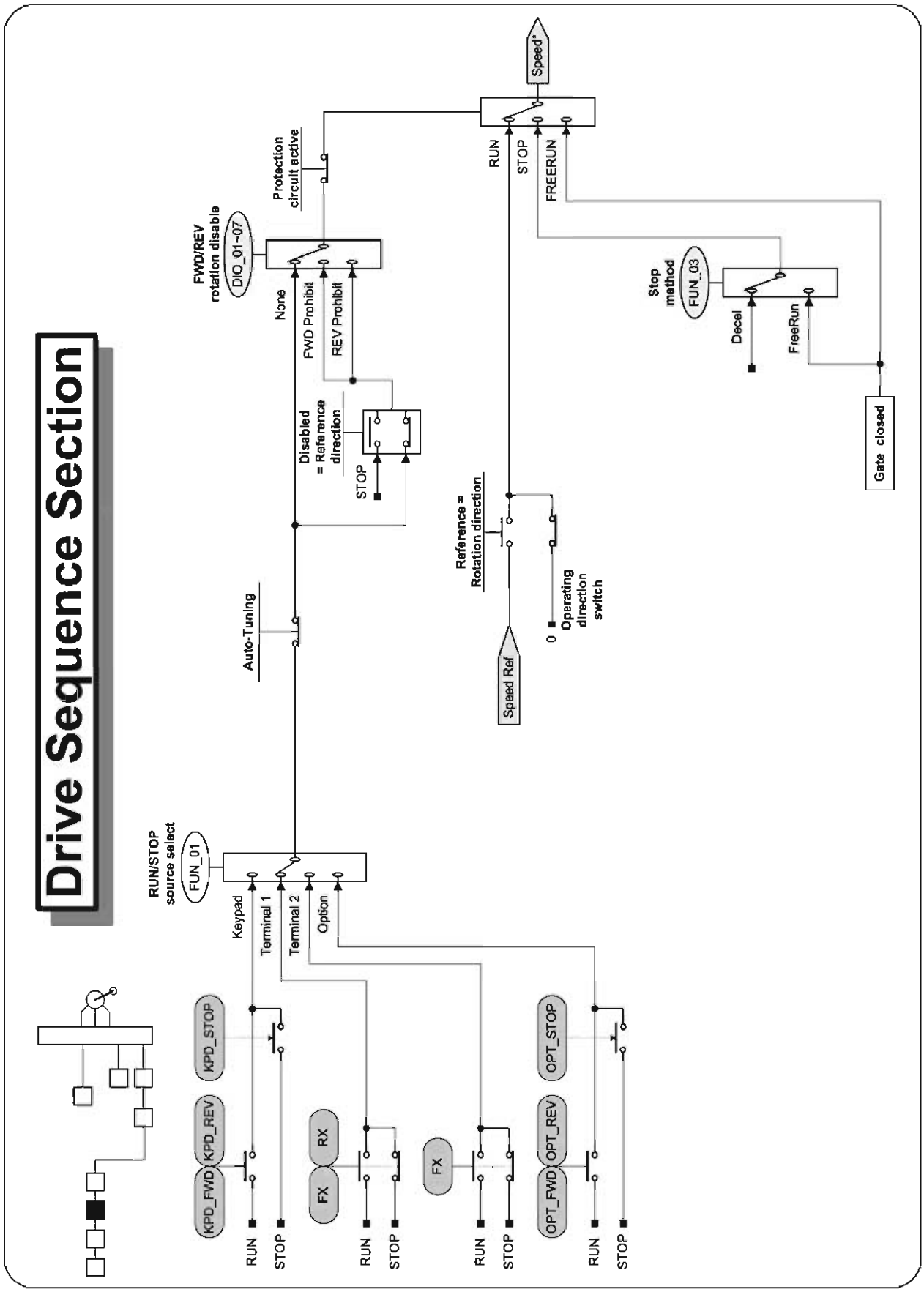

Setpoint setting(AI0:AI1)
* AI2 ~ AI3 setting follows this Sequence
AI1 input definition
AIO_01
None
Speed Ref
Proc PID Ref
Proc PID F/B
Draw Ref
Torque Ref
Flux Ref
Torque Bias
Torque Limit
Line SPD Ref
Tension Ref
Dancer Ref
Taper Ref
Tension F/B
Diameter
Diam Preset
AI1 input mode
AIO_02
-10 ~ 10V
10 ~ -10V
0 ~ 10V
10 ~ 0V
0 ~ 20mA
20 ~ 0mA
Gain/Bias
AIO_03~10
LPF
AIO_11
LPF time constana
AI1
Gain, Bais setting (10 ~ -10V)
AI1 In X1 = 0 %
AI1 Out Y1 = 0 %
Voltage
5V
10V
AI1 Out Y2 = 50 %
AI1 Out Y2 = 100 %
AI1 Out Y2 =200 %
Maximum Speed / 2
Maximum Speed
Speed
Gain, Bais setting (10~0V, 20~0mA)
AI1 Out Y2 =200 %
AI1 Out Y2 = 100 %
AI1 Out Y2 = 50 %
AI1 Out Y1 =0%
5V,10mA Voltage, Current
10V,20mA
Gain, Bais setting (-10~10V, 0~20mA)
AI1 In X1: = 0%
AI1 Out Y2 = 75 %
AI1 Out Y1 = 25%
AI1 Out Y1 = 0 %
AI1 Out Y1 =-10%
AI1 In X1 = 0 %
AI1 Out Y1 = 0 %

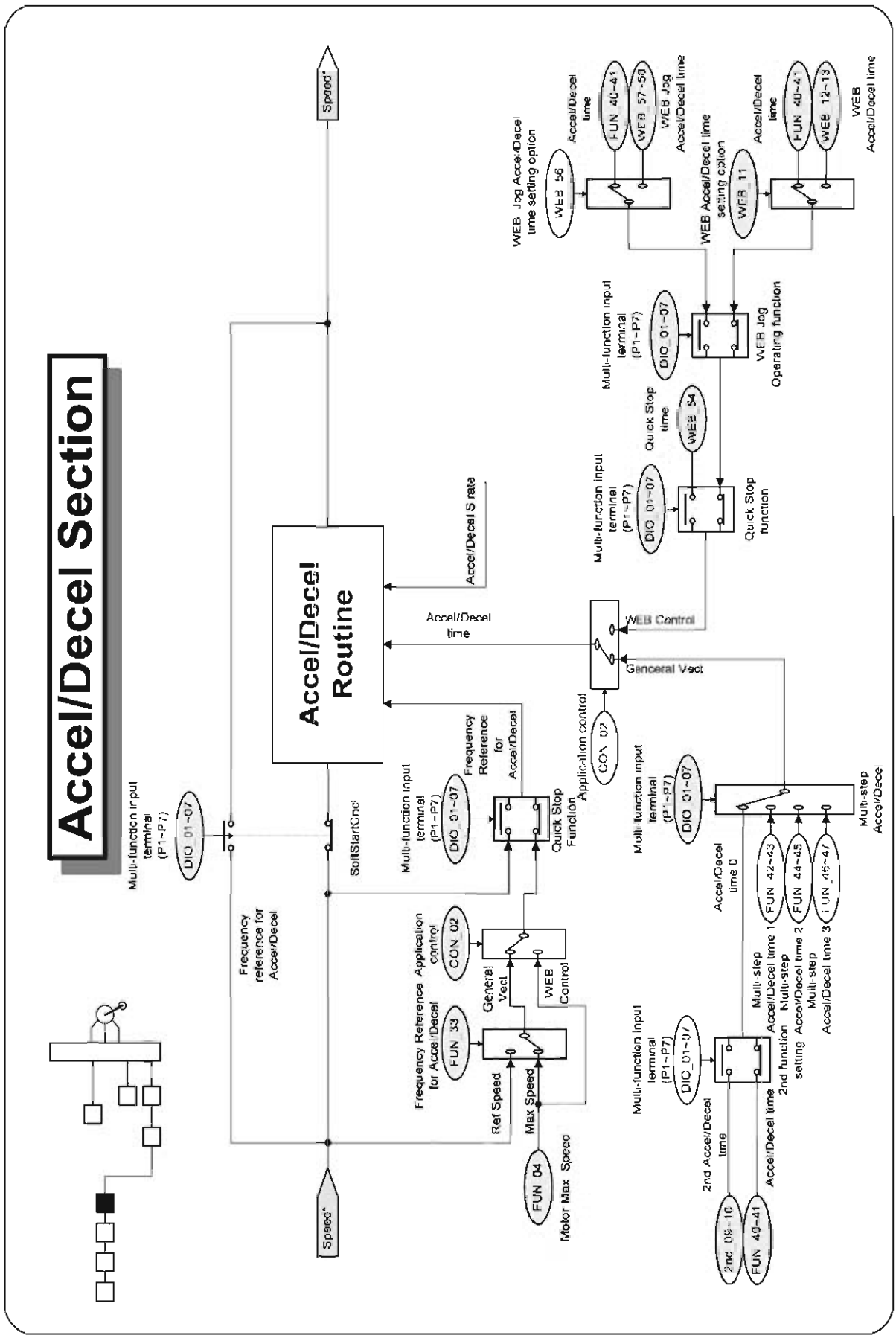

Freq./Speed setting
Speed Ref
Application control
CON_02
Multi-function input terminal setting (P1~P7)
DIO_01~07
Genera Vect
Jog operatopn
WEB Control
Jog speed reference
FUN_20
Up/Down operation
Up/Down operating Freq reference
Motor Max Speed
FUN_04
Limit
Speed-L
Speed-M
Speed-H
Multi-function input terminal (P1~P7)
DIO_01~07
Multi-step(MS) spd 0
FUN_13
FUN_14
FUN_15
FUN_16
FUN_17
FUN_18
FUN_19
Speed setting
FUN_02
Analog Input
Keypad 1
Keypad 2
Option Input
Limit
Speed Ref
FUN_12
Option Freq. / Speed Reference
Option
Draw quantity
CON_22
Draw Reference
Draw Ref
Max motor rotating speed at Min diameter
WEB_08
Limit
WEB Jog Speed setting
WEB_09
Multi-function input terminal setting (P1~P7)
DIO_01~07
WEB Jog operating function setting
Speed Calculator
Refer to P 7-42 line speed block diagram
Line Speed Ref
WEB spd reference(Analog)
WEB spd reference(Option)
Line SPD Ref
Line SPD Opt

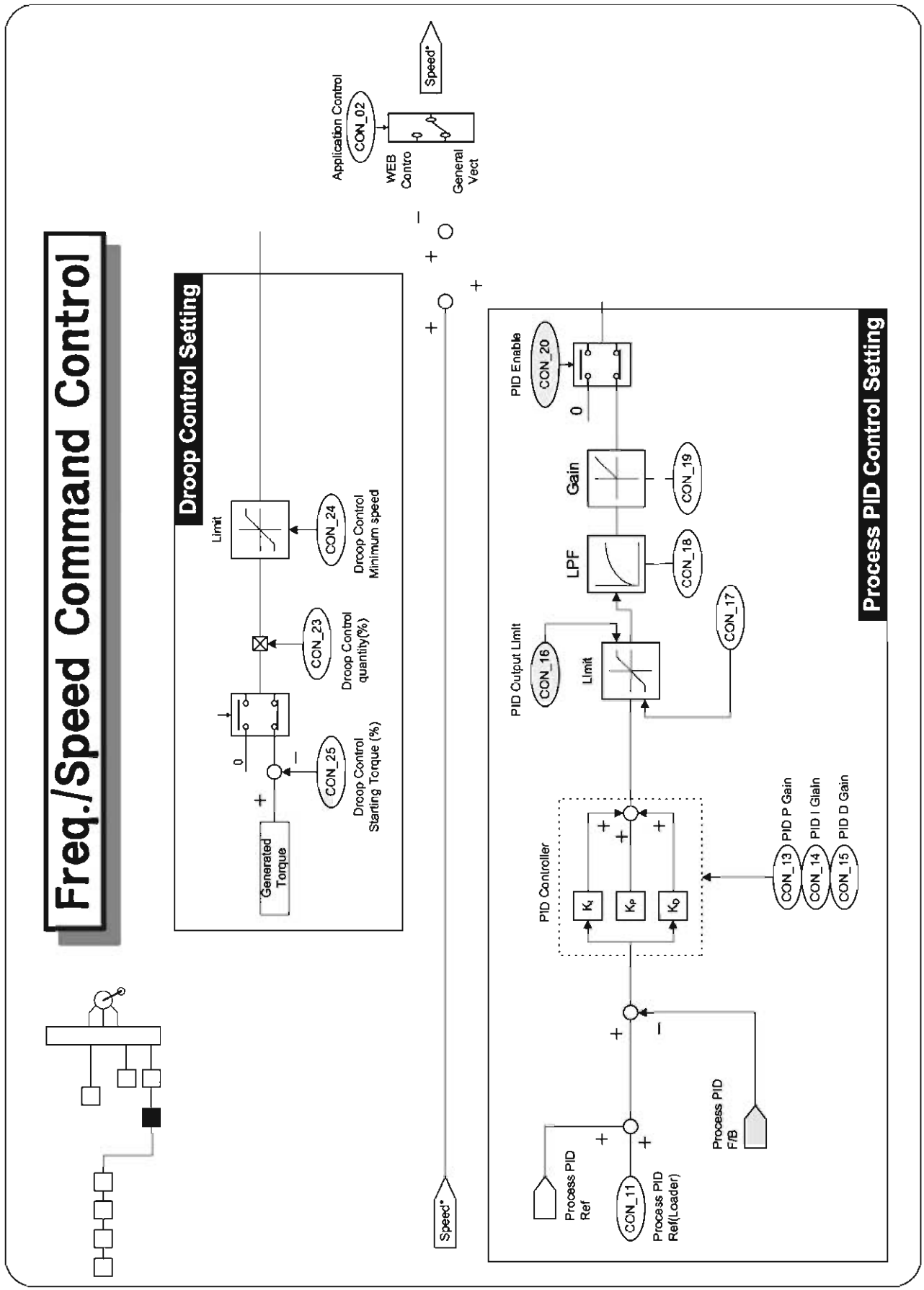
# Freq./Speed Reference

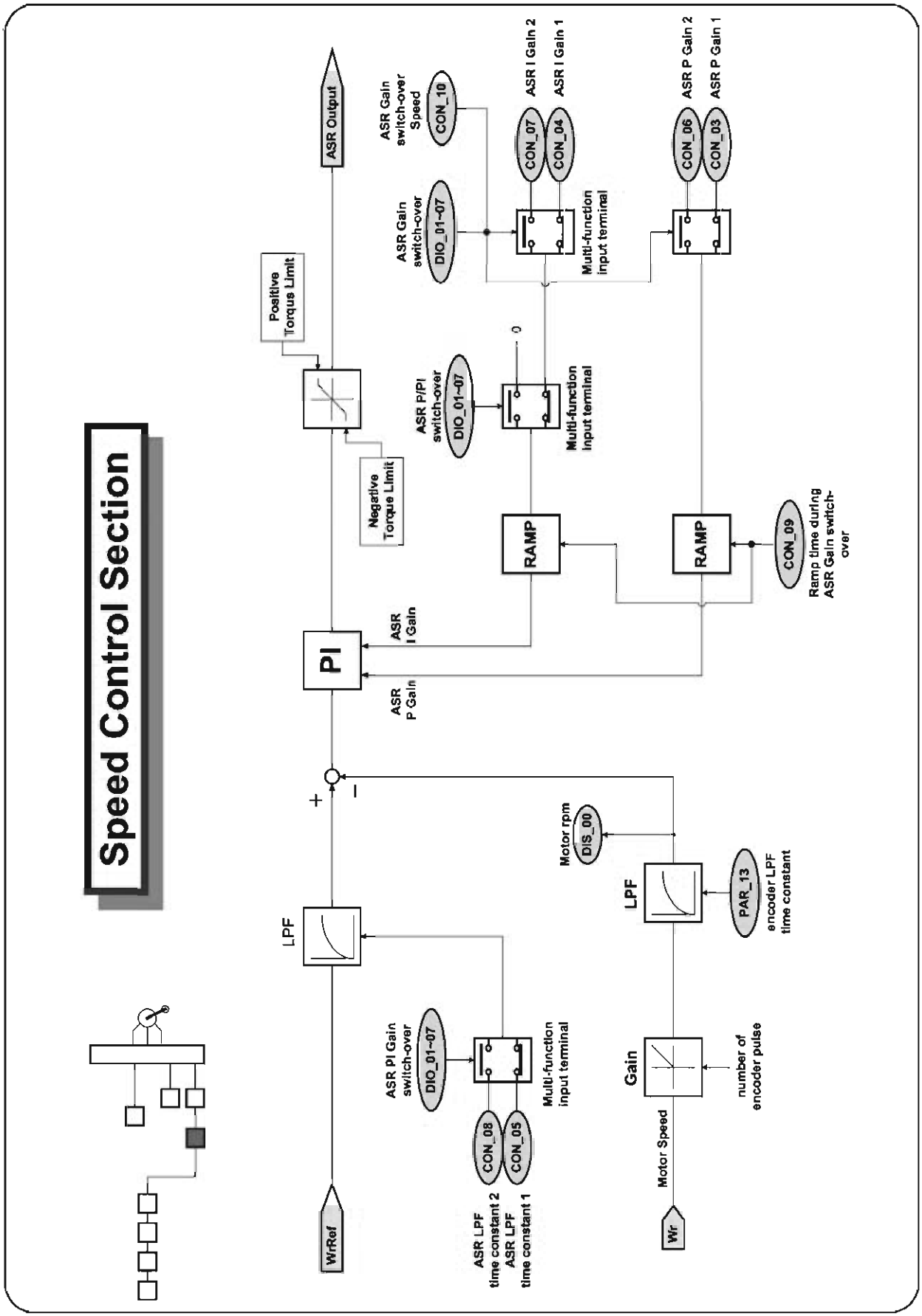


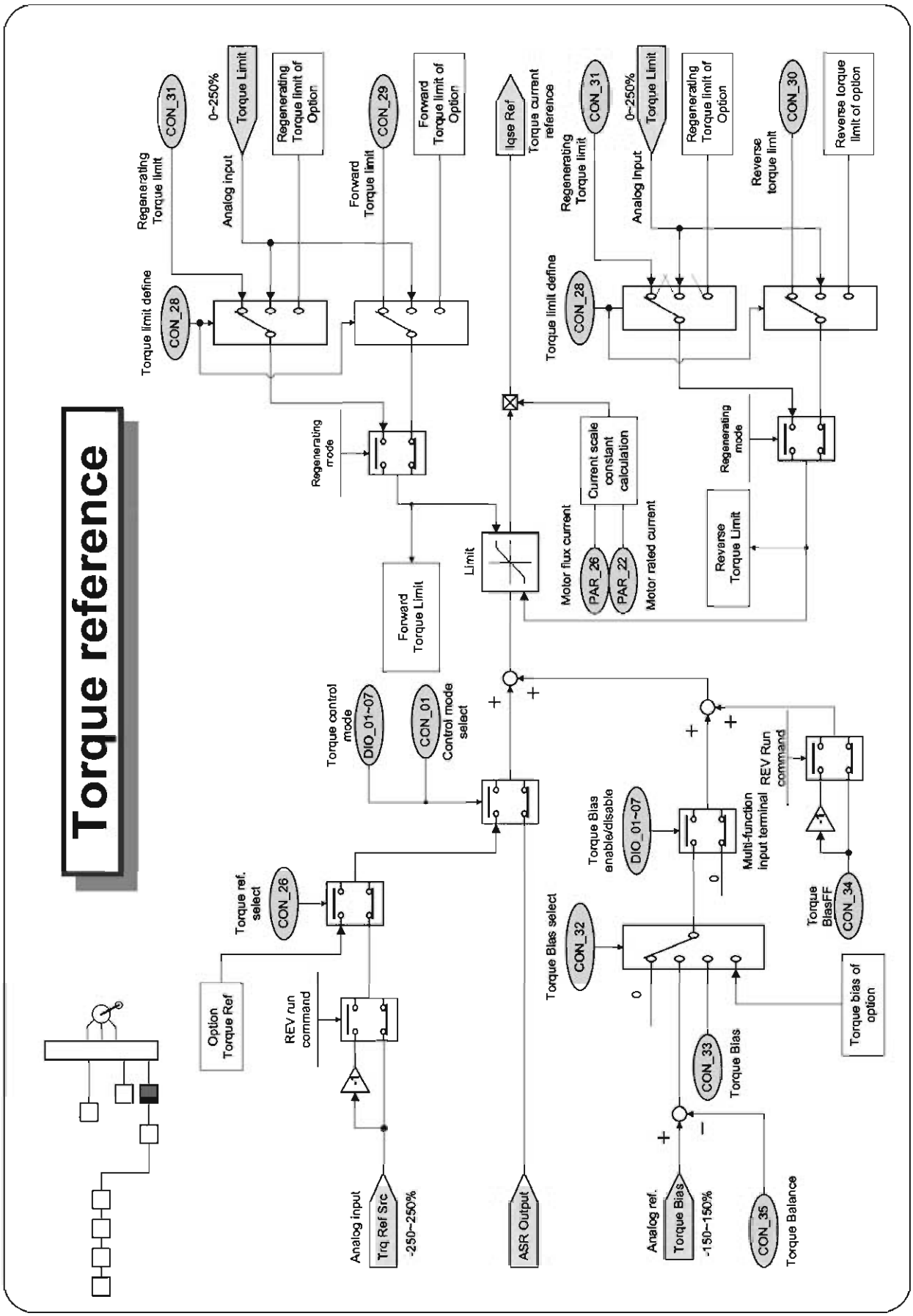



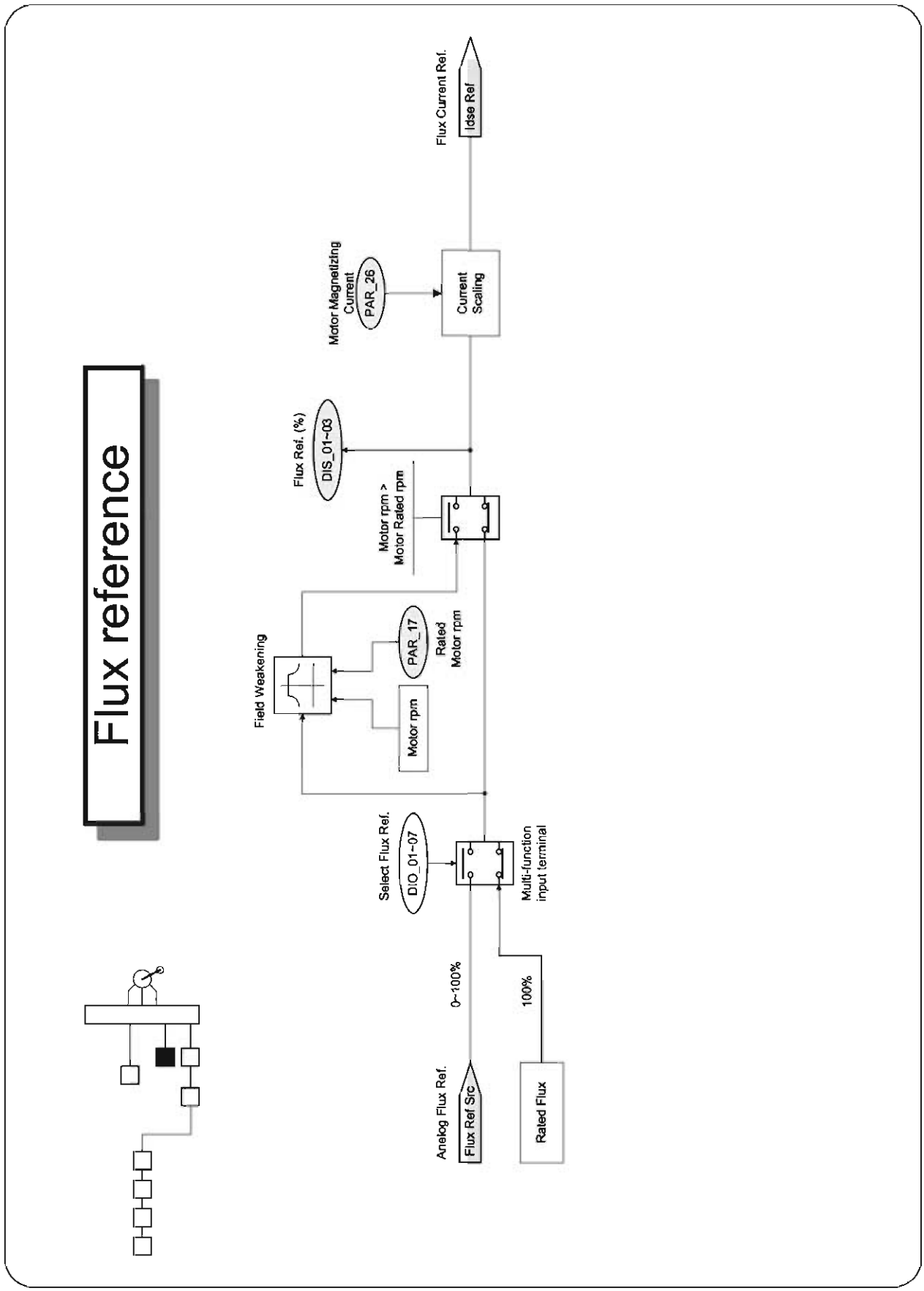

Drive Sequence Section
RUN/STOP source select
FUN_01
Keypad
Terminal 1
Terminal 2
Option
Auto-Tuning
FWD/REV rotation disable
DIO_01~07
None
FWD Prohibit
REV Prohibit
Protection circuit active
Disabled = Reference direction
STOP
Reference = Rotation direction
Speed Ref
0
Operating direction switch
Speed*
RUN
STOP
FREERUN
Stop method
FUN_03
Decel
FreeRun
Gate closed
KPD_FWD
KPD_REV
KPD_STOP
FX
RX
OPT_FWD
OPT_REV
OPT_STOP
RUN
STOP

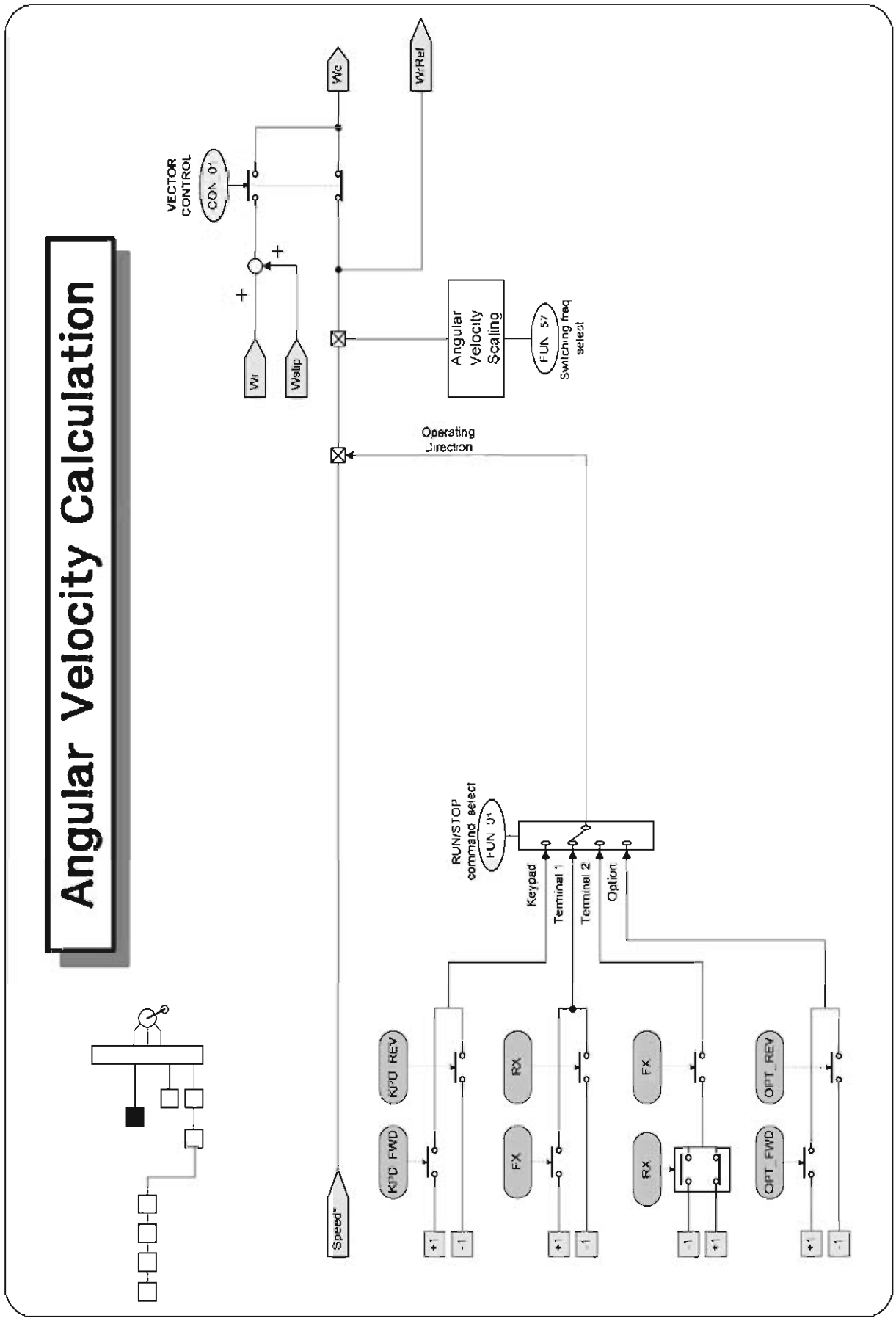

Accel/Decel Section
Accel/Decel Routine
Speed*
Speed*
Accel/Decel S rate
Accel/Decel time
Frequency reference for Accel/Decel
SoftStartCnc
Multi-function input terminal (P1~P7)
DIO_01~07
Frequency Reference for Accel/Decel
FUN_33
Application control
CON_02
General Vect
WEB Control
Ref Speed
Max Speed
FUN_04
Motor Max Speed
Quick Stop Function
WEB Control
General Vect
Quick Stop function
Quick Stop time
WEB_54
WEB Jog Operating function
WEB Jog Accel/Decel time setting option
WEB_56
WEB Accel/Decel time setting option
WEB_11
Accel/Decel time
FUN_40~41
WEB_57~58
WEB Jog Accel/Decel time
WEB_12~13
WEB Accel/Decel time
Multi-step Accel/Decel
Accel/Decel time 0
FUN_42~43
FUN_44~45
FUN_46~47
Multi-step Accel/Decel time 1
Multi-step Accel/Decel time 2
Multi-step Accel/Decel time 3
2nd function setting
2nd Accel/Decel time
Accel/Decel time
2nd_08~10
FUN_40~41

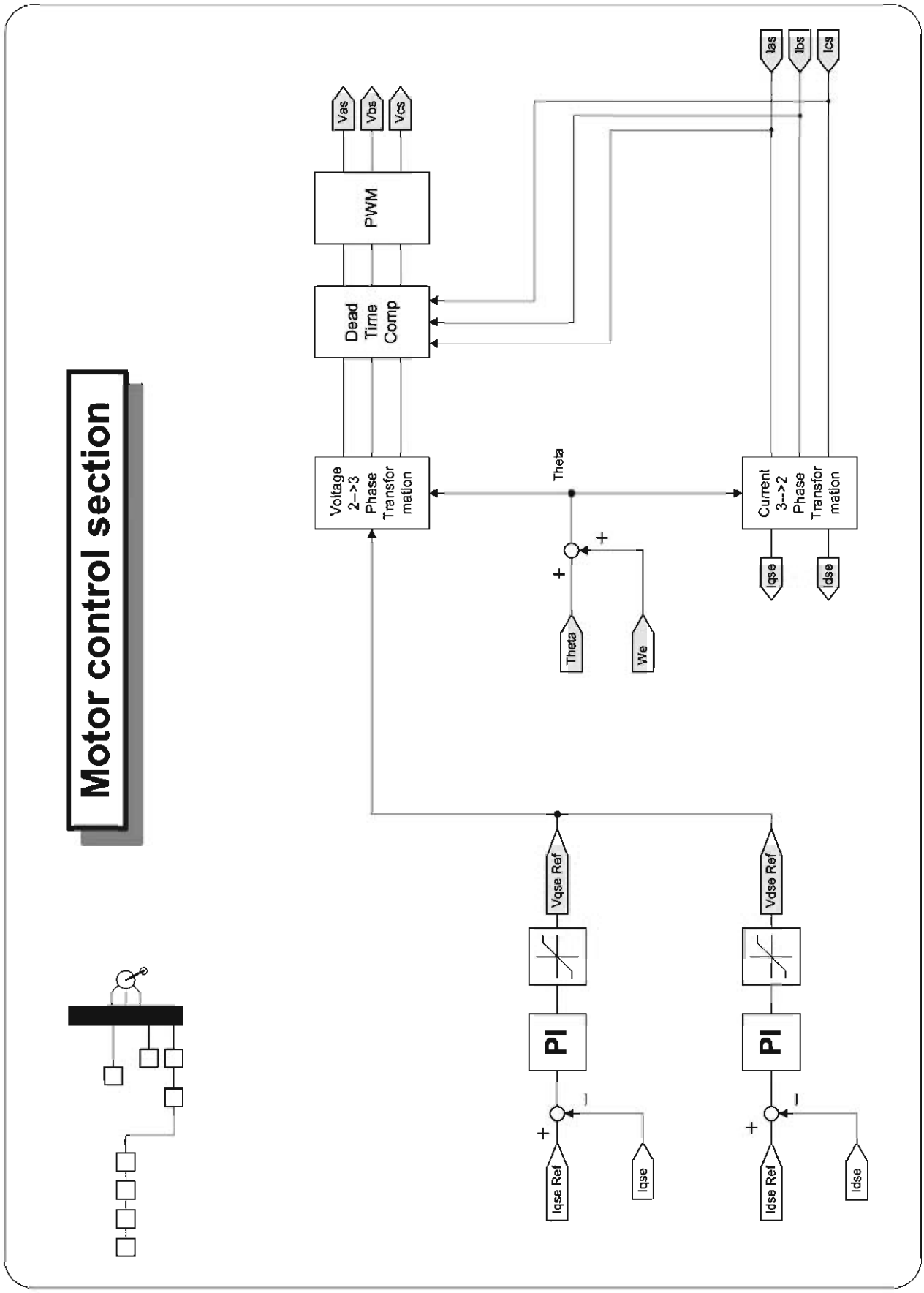

Freq./Speed Command Control
Droop Control Setting
Limit
CON_24
Droop Control Minimum speed
CON_23
Droop Control quantity(%)
CON_25
Droop Control Starting Torque (%)
Generated Torque
Application Control
CON_02
WEB Contro
General Vect
Speed*
Process PID Control Setting
PID Enable
CON_20
Gain
CON_19
LPF
CON_18
PID Output Limit
CON_16
Limit
CON_17
PID Controller
Ki
Kp
Kd
CON_13
PID P Gain
CON_14
PID I Gain
CON_15
PID D Gain
Process PID Ref
CON_11
Process PID Ref(Loader)
Process PID F/B
Speed*

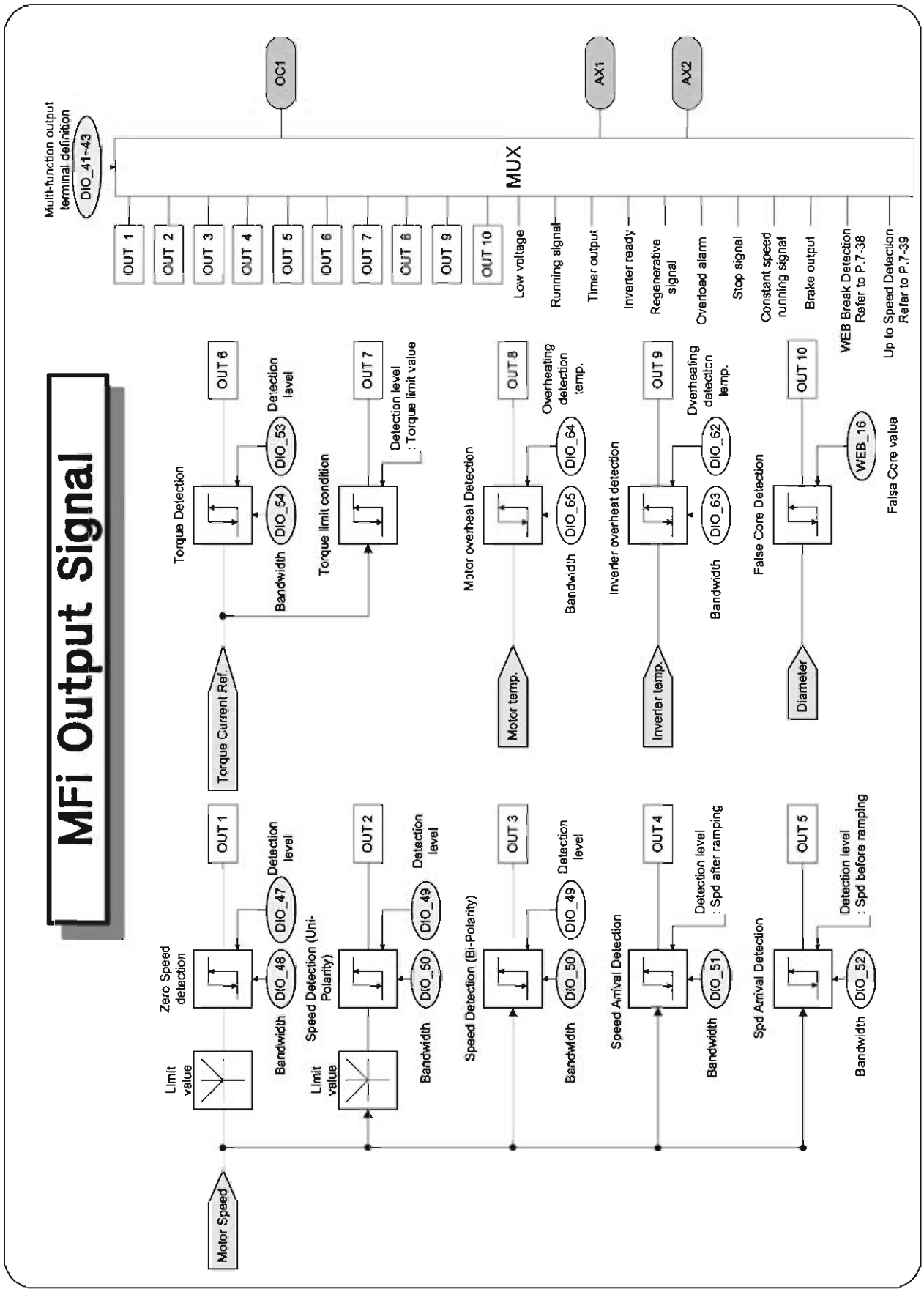

Speed Control Section
ASR Output
ASR Gain switch-over Speed
CON_10
ASR I Gain 2
ASR I Gain 1
CON_07
CON_04
ASR P Gain 2
ASR P Gain 1
CON_06
CON_03
ASR Gain switch-over
DIO_01~07
Multi-function input terminal
Positive Torque Limit
ASR P/PI switch-over
DIO_01~07
Multi-function input terminal
Negative Torque Limit
RAMP
RAMP
CON_09
Ramp time during ASR Gain switch-over
PI
ASR I Gain
ASR P Gain
+
-
Motor rpm
DIS_00
LPF
LPF
PAR_13
encoder LPF time constant
ASR PI Gain switch-over
DIO_01~07
Multi-function input terminal
Gain
number of encoder pulse
CON_08
CON_05
ASR LPF time constant 2
ASR LPF time constant 1
Motor Speed
WrRef
Wr


Torque reference
Regenerating Torque limit
CON_31
0~250%
Torque Limit
Analog input
Regenerating Torque limit of Option
Forward Torque limit
CON_29
Forward Torque limit of Option
Torque limit define
CON_28
Regenerating mode
Forward Torque Limit
Limit
Iqse Ref
Torque current reference
Current scale constant calculation
Motor flux current
PAR_26
PAR_22
Motor rated current
Regenerating Torque limit
CON_31
0~250%
Torque Limit
Analog Input
Regenerating Torque limit of Option
Reverse torque limit
CON_30
Reverse torque limit of option
Torque limit define
CON_28
Regenerating mode
Reverse Torque Limit
Torque control mode
DIO_01~07
CON_01
Control mode select
Torque ref. select
CON_26
Option Torque Ref
REV run command
Analog input
Trq Ref Src
-250~250%
ASR Output
Torque Bias enable/disable
DIO_01~07
Multi-function input terminal
REV Run command
Torque BiasFF
CON_34
Torque Bias select
CON_32
Torque bias of option
CON_33
Torque Bias
Analog ref.
Torque Bias
-150~150%
CON_35
Torque Balance


Flux reference
Flux Current Ref.
Idse Ref
Motor Magnetizing Current
PAR_26
Current Scaling
Flux Ref. (%)
DIS_01-03
Motor rpm > Motor Rated rpm
Field Weakening
PAR_17
Rated Motor rpm
Motor rpm
Select Flux Ref.
DIO_01-07
Multi-function input terminal
0~100%
100%
Analog Flux Ref.
Flux Ref Src
Rated Flux


Angular Velocity Calculation
We
W-Ref
VECTOR CONTROL
CON 0'
Wi
Wslip
Angular Velocity Scaling
FUN 57
Switching freq select
Operating Direction
RUN/STOP command select
FUN 01
Keypad
Terminal 1
Terminal 2
Option
KPD REV
KPD FWD
RX
FX
FX
RX
OPT_REV
OPT_FWD
Speed*


Motor control section
Vas
Vbs
Vcs
PWM
Dead Time Comp
Voltage 2->3 Phase Transfor mation
Theta
Current 3->2 Phase Transfor mation
Iqse
Idse
Theta
We
Vqse Ref
Vdse Ref
PI
PI
Iqse Ref
Iqse
Idse Ref
Idse


MFi Output Signal
Multi-function output terminal definition
DIO_41~43
MUX
OC1
AX1
AX2
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
Low voltage
Running signal
Timer output
Inverter ready
Regenerative signal
Overload alarm
Stop signal
Constant speed running signal
Brake output
WEB Break Detection Refer to P.7-38
Up to Speed Detection Refer to P.7-39
Torque Detection
Detection level
DIO_53
Bandwidth
DIO_54
Torque Current Ref.
Torque limit condition
Detection level : Torque limit value
Motor overheat Detection
Overheating detection temp.
DIO_64
DIO_65
Motor temp.
Inverter overheat detection
Overheating detection temp.
DIO_62
DIO_63
Inverter temp.
False Core Detection
WEB_16
False Core value
Diameter
Zero Speed detection
DIO_47
DIO_48
Limit value
Speed Detection (Uni-Polarity)
DIO_49
DIO_50
Speed Detection (Bi-Polarity)
Speed Arrival Detection
Detection level : Spd after ramping
DIO_51
Spd Arrival Detection
Detection level : Spd before ramping
DIO_52
Motor Speed

MEMO

# ADDITIONAL UL MARKING

### 1. Short Circuit Rating

"Suitable For Use On A Circuit Capable Of Delivering Not More Than Table1* RMS Symmetrical Amperes, 240 for rated 240V drives or 480 for rated 480V drives Volts Maximum," or equivalent.

Table1*

| Inverter Capacity | Rating |
|---|---|
| 200/400V Class: 5.5kW, 7.5kW, 11kW, 15kW, 18.5 kW, 22kW, 30kW, 37kW | 5,000A |
| 400V Class: 45kW, 55kW, 75kW, 90kW, 110kW, 132kW | 10,000A |
| 400V Class: 160kW, 220kW | 18,000A |

### 2. SHORT CIRCUIT FUSE/BREAKER MARKING

Use Class H or K5 UL Listed Input Fuse and UL Listed Breaker Only. See the table below for the Voltage and Current rating of the fuses and the breakers.

| Input [V] | Inverter [kW] | External Fuse | | Breaker | | Internal Fuse | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Current [A] | Voltage [V] | Current [A] | Voltage [V] | Current [A] | Voltage [Vac/dc] | Manufacturer | Model Number |
| 200 Class | 5.5 | 40 | 500 | 50 | 220 | 60 | 250 | Hinode Elec | 250GH-60 |
| | 7.5 | 50 | 500 | 60 | 220 | 60 | 250 | Hinode Elec | 250GH-60 |
| | 11 | 70 | 500 | 100 | 220 | 125 | 250 | Hinode Elec | 250GH-125 |
| | 15 | 100 | 500 | 100 | 220 | 150 | 250 | Hinode Elec | 250GH-150 |
| | 18.5 | 100 | 500 | 225 | 220 | 175 | 250 | Hinode Elec | 250GH-175 |
| | 22 | 125 | 500 | 225 | 220 | 225 | 250 | Hinode Elec | 250GH-225 |
| | 30 | 150 | 500 | 225 | 220 | 250 | 250 | Hinode Elec | 250GH-250S |
| | 37 | 200 | 500 | 225 | 220 | 250 | 250 | Hinode Elec | 250GH-250S |
| 400 Class | 5.5 | 20 | 500 | 30 | 460 | 35 | 660 | Hinode Elec | 660GH-35 |
| | 7.5 | 30 | 500 | 30 | 460 | 35 | 660 | Hinode Elec | 660GH-35 |
| | 11 | 35 | 500 | 50 | 460 | 63 | 660 | Hinode Elec | 660GH-63 |
| | 15 | 45 | 500 | 60 | 460 | 80 | 660 | Hinode Elec | 660GH-80 |
| | 18.5 | 60 | 500 | 100 | 460 | 100 | 660 | Hinode Elec | 660GH-100 |
| | 22 | 70 | 500 | 100 | 460 | 125 | 660 | Hinode Elec | 660GH-125 |
| | 30 | 100 | 500 | 100 | 460 | 125 | 600 | Hinode Elec | 600FH-125S |
| | 37 | 100 | 500 | 225 | 460 | 150 | 600 | Hinode Elec | 600FH-150S |
| | 45 | 100 | 500 | 225 | 460 | 200 | 600 | Hinode Elec | 600FH-200S |
| | 55 | 150 | 500 | 225 | 460 | 200 | 600 | Hinode Elec | 600FH-200S |
| | 75 | 200 | 500 | 225 | 460 | 125 | 600 | Hinode Elec | 600FH-125S |
| | 90 | 250 | 500 | 400 | 460 | 200 | 600 | Hinode Elec | 600FH-200S |
| | 110 | 300 | 500 | 400 | 460 | 200 | 600 | Hinode Elec | 600FH-200S |
| | 132 | 400 | 500 | 400 | 460 | 300 | 600 | Hinode Elec | 600FH-300S |
| | 160 | 400 | 500 | 400 | 460 | 300 | 600 | Hinode Elec | 600FH-300S |
| | 220 | — | — | 600 | 460 | 600 | 600 | Hinode Elec | 600SPF-600UL |

### 3. FIELD WIRING TERMINAL

1) Use Copper wires only with Copper conductors, 75℃
2) Input and motor output terminal blocks are intended only for use with ring type connectors.

### 4. CAUTION-Risk of Electric Shock

"Before opening the cover, disconnect all power and wait at least 10 minutes"

Units suitable only for use in a pollution degree 2 environment. Be sure to mount the inverter in a forced-ventilated o eratin anel.
p g p

# EC DECLARATION OF CONFORMITY

**We, the undersigned,**

| | |
|---|---|
| Representative: | **LS Industrial Systems Co., Ltd.** |
| Address: | **LS Tower, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do 1026-6, Korea** |
| Manufacturer: | **LS Industrial Systems Co., Ltd.** |
| Address: | **181, Samsung-ri, Mokchon-Eup, Chonan, Chungnam, 330-845, Korea** |

**Certify and declare under our sole responsibility that the following apparatus:**

| | |
|---|---|
| Type of Equipment: | **Inverter (Power Conversion Equipment)** |
| Model Name: | **STARVERT-iV5 series** |
| Trade Mark: | **LS Industrial Systems Co., Ltd.** |

**conforms with the essential requirements of the directives:**

2006/95/EC Directive of the European Parliament and of the Council on the harmonisation of the laws of Member States relating to Electrical Equipment designed for use within certain voltage limits

2004/108/EC Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility

**based on the following specifications applied:**

**EN 61800-3:2004**
**EN 50178:1997**

**and therefore complies with the essential requirements and provisions of the 2006/95/CE and 2004/108/CE Directives.**

Place: **Chonan, Chungnam, Korea**

16/01/2009 (Signature /Date)

Mr. Dok Ko Young Chul / Factory Manager
(Full name / Position)

# EMI / RFI POWER LINE FILTERS
## LS inverters, iV5 series

**RFI FILTERS**

THE LS RANGE OF POWER LINE FILTERS FF ( Footprint ) - FE ( Standard ) SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY LG INVERTERS. THE USE OF LS FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARDS TO EN 50081.

**CAUTION**

IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF. IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER THAN VALUE OF LAKAGE CURRENT AT WORST CASE IN THE BELOW TABLE.

### RECOMMENDED INSTALLATION INSTRUCTIONS

To conform to the EMC directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

1- ) Check the filter rating label to ensure that the current, voltage rating and part number are correct.

2- ) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclousure, usually directly after the enclousures circuit breaker or supply switch.

3- ) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.

4- ) Mount the filter securely.

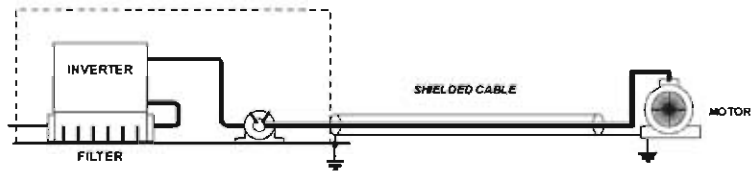
5- ) Connect the mains supply to the filter terminals marked LINE, connect any earth cables to the earth stud provided. Connect the filter terminals marked LOAD to the mains input of the inverter using short lengths of appropriate gauge cable.

6- ) Connect the motor and fit the ferrite core ( output chokes ) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclousure body via and earthed cable gland.

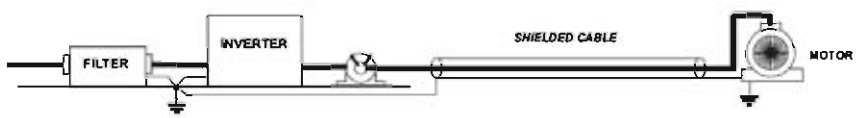
7- ) Connect any control cables as instructed in the inverter instructions manual.

IT IS IMPORTANT THAT ALL LEAD LENGHTS ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOING MOTOR CABLES ARE KEPT WELL SEPARATED.

FF SERIES ( Footprint )




FE SERIES ( Standard )



**iV5 series / Footprint Filters**

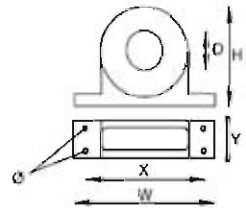
| INVERTER | POWER | CODE | CURRENT | VOLTAGE | LEAKAGE CURRENT NOM. | LEAKAGE CURRENT MAX. | DIMENSIONS L W H | MOUNTING Y X | WEIGHT | MOUNT | FIG. | OUTPUT CHOKES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THREE PHASE | | | | | | | | | | | | |
| SV022iV5-2 (DB) | 2.2kW | FFV5-T020-(x) | 20A | 250VAC | 0.5mA | 27mA | 329x199.5x60 | 315x160 | 1.8Kg. | M5 | A | FS-2 |
| SV037iV5-2 (DB) | 3.7kW | | | | | | | | | | | |
| SV055iV5-2 (DB) | 5.5kW | FFV5-T030-(x) | 30A | 250VAC | 0.5mA | 27mA | 451x234.5x60 | 437x190 | 2.1Kg. | M5 | A | FS-2 |
| SV075iV5-2 (DB) | 7.5kW | FFV5-T050-(x) | 50A | 250VAC | 0.5mA | 27mA | 451x234.5x60 | 437x190 | 2.6Kg. | M5 | A | FS-2 |
| SV110iV5-2 (DB) | 11kW | | 100A | 250VAC | 0.5mA | 27mA | | | | | | |
| SV150iV5-2 (DB) | 15kW | | | | | | | | | | | |
| SV185iV5-2 (DB) | 18kW | | 120A | 250VAC | 0.5mA | 27mA | | | | | | |
| SV220iV5-2 (DB) | 22kW | | | | | | | | | | | |
| SV300iV5-2 (DB) | 30kW | | 150A | 250VAC | 0.5mA | 27mA | | | | | | |
| SV370iV5-2 (DB) | 37kW | | 180A | 250VAC | 0.5mA | 27mA | | | | | | |
| SV022iV5-4 (DB) | 2.2kW | FFV5-T011-(x) | 11A | 380VAC | 0.5mA | 27mA | 329x199.5x60 | 315x160 | 1.5Kg. | M5 | A | FS-2 |
| SV037iV5-4 (DB) | 3.7kW | | | | | | | | | | | |
| SV055iV5-4 (DB) | 5.5kW | FFV5-T030-(x) | 30A | 380VAC | 0.5mA | 27mA | 451x234.5x60 | 437x190 | 2Kg. | M5 | A | FS-2 |
| SV075iV5-4 (DB) | 7.5kW | | | | | | | | | | | |
| SV110iV5-4 (DB) | 11kW | FFV5-T051-(x) | 51A | 380VAC | 0.5mA | 27mA | 605x335x65 | 579.5x265 | 2.5Kg. | M8 | A | FS-2 |
| SV150iV5-4 (DB) | 15kW | | | | | | | | | | | |
| SV185iV5-4 (DB) | 18kW | FFV5-T060-(x) | 60A | 380VAC | 0.5mA | 27mA | 605x335x65 | 579.5x265 | 2.8Kg. | M8 | A | FS-2 |
| SV220iV5-4 (DB) | 22kW | FFV5-T070-(x) | 70A | 380VAC | 0.5mA | 27mA | 605x335x65 | 579.5x265 | 2.8Kg. | M8 | A | FS-3 |
| SV300iV5-4 (DB) | 30kW | FFV5-T071-(x) | 71A | 380VAC | 0.5mA | 27mA | 756x350x65 | 730.5x281 | 3Kg. | M8 | A | FS-3 |
| SV370iV5-4 (DB) | 37kW | | 100A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV450iV5-4 (DB) | 45kW | | 120A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV550iV5-4 (DB) | 55kW | | | | | | | | | | | |
| SV750iV5-4 (DB) | 75kW | | 170A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV900iV5-4 (DB) | 90kW | | 230A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV1100iV5-4 (DB) | 110kW | | 400A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV1320iV5-4 (DB) | 132kW | | | | | | | | | | | |
| SV1600iV5-4 (DB) | 160kW | | 600A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV2200iV5-4 (DB) | 220kW | | | | | | | | | | | |
| SV2800iV5-4 (DB) | 280kW | | 1000A | 380VAC | 0.5mA | 27mA | | | | | | |
| SV3150iV5-4 (DB) | 315kW | | | | | | | | | | | |
| SV3750iV5-4 (DB) | 375kW | | | | | | | | | | | |
| SV055iV5-2DB (MD) | 5.5kW | FFV5-T031-(x) | 31A | 250VAC | 0.5mA | 27mA | 400x199.5x60 | 386x160 | 2Kg. | M5 | A | FS-2 |
| SV075iV5-2DB (MD) | 7.5kW | FFV5-T052-(x) | 52A | 250VAC | 0.5mA | 27mA | 400x199.5x60 | 386x160 | 2.5Kg. | M5 | A | FS-2 |
| SV110iV5-2DB (MD) | 11kW | | 100A | 250VAC | 0.5mA | 27mA | | | | | A | FS-2 |
| SV150iV5-2DB (MD) | 15kW | | | | | | | | | | | |
| SV185iV5-2DB (MD) | 18kW | | 120A | 250VAC | 0.5mA | 27mA | | | | | A | FS-2 |
| SV220iV5-2DB (MD) | 22kW | | | | | | | | | | | |
| SV055iV5-4DB (MD) | 5.5kW | FFV5-T031-(x) | 31A | 380VAC | 0.5mA | 27mA | 400x199.5x60 | 386x160 | 2Kg. | M5 | A | FS-2 |
| SV075iV5-4DB (MD) | 7.5kW | | | | | | | | | | | |
| SV110iV5-4DB (MD) | 11kW | FFV5-T053-(x) | 53A | 380VAC | 0.5mA | 27mA | 466x258x65 | 440.5x181 | 2.5Kg. | M5 | A | FS-2 |
| SV150iV5-4DB (MD) | 15kW | | | | | | | | | | | |
| SV185iV5-4DB (MD) | 18kW | FFV5-T061-(x) | 61A | 380VAC | 0.5mA | 27mA | 541x312x65 | 515.5x235 | 2.6Kg. | M8 | A | FS-2 |
| SV220iV5-4DB (MD) | 22kW | FFV5-T072-(x) | 72A | 380VAC | 0.5mA | 27mA | 541x312x65 | 515.5x235 | 2.8Kg. | M8 | A | FS-3 |

X (1) Industrial environment EN 50081-2 (A class) → EN61000-6-4:02
(2) Domestic and industrial environment EN50081-1 (B class) -> EN61000-6-3:02

**iV5** series / Standard Filters

| INVERTER | POWER | CODE | CURRENT | VOLTAGE | LEAKAGE CURRENT NOM. MAX. | DIMENSIONS L W H | MOUNTING Y X | WEIGHT | MOUNT | FIG. | OUTPUT CHOKES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| THREE PHASE | | | | | | | | | | | |
| SV022iV5-2 (DB) | 2.2kW | FE-T020-(x) | 20A | 250VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.2Kg. | --- | B | FS-2 |
| SV037iV5-2 (DB) | 3.7kW | | | | | | | | | | |
| SV055iV5-2 (DB) | 5.5kW | FE-T030-(x) | 30A | 250VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.4Kg. | --- | B | FS-2 |
| SV075iV5-2 (DB) | 7.5kW | FE-T050-(x) | 50A | 250VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.2Kg. | --- | B | FS-2 |
| SV110iV5-2 (DB) | 11kW | FE-T100-(x) | 100A | 250VAC | 0.5mA 27mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV150iV5-2 (DB) | 15kW | | | | | | | | | | |
| SV185iV5-2 (DB) | 18kW | FE-T120-(x) | 120A | 250VAC | 0.5mA 27mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV220iV5-2 (DB) | 22kW | | | | | | | | | | |
| SV300iV5-2 (DB) | 30kW | FE-T150-(x) | 150A | 250VAC | 0.5mA 27mA | 480x200x160 | 468x166 | 15Kg. | --- | B | FS-3 |
| SV370iV5-2 (DB) | 37kW | FE-T170-(x) | 170A | 250VAC | 0.5mA 27mA | 480x200x160 | 468x166 | 16Kg. | --- | B | FS-3 |
| SV022iV5-4 (DB) | 2.2kW | FE-T012-(x) | 12A | 380VAC | 0.5mA 27mA | 250x110x60 | 238x76 | 1.6Kg. | --- | B | FS-2 |
| SV037iV5-4 (DB) | 3.7kW | | | | | | | | | | |
| SV055iV5-4 (DB) | 5.5kW | FE-T030-(x) | 30A | 380VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.4Kg. | --- | B | FS-2 |
| SV075iV5-4 (DB) | 7.5kW | | | | | | | | | | |
| SV110iV5-4 (DB) | 11kW | FE-T050-(x) | 50A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.2Kg. | --- | B | FS-2 |
| SV150iV5-4 (DB) | 15kW | | | | | | | | | | |
| SV185iV5-4 (DB) | 18kW | FE-T060-(x) | 60A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.5Kg. | --- | B | FS-2 |
| SV220iV5-4 (DB) | 22kW | FE-T070-(x) | 70A | 380VAC | 0.5mA 27mA | 350x180x90 | 338x146 | 7.5Kg. | --- | B | FS-3 |
| SV300iV5-4 (DB) | 30kW | | | | | | | | | | |
| SV370iV5-4 (DB) | 37kW | FE-T100-(x) | 100A | 380VAC | 1.3mA 150mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV450iV5-4 (DB) | 45kW | FE-T120-(x) | 120A | 380VAC | 1.3mA 150mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV550iV5-4 (DB) | 55kW | | | | | | | | | | |
| SV750iV5-4 (DB) | 75kW | FE-T170-(x) | 170A | 380VAC | 1.3mA 150mA | 480x200x160 | 468x166 | 16Kg. | --- | B | FS-3 |
| SV900iV5-4 (DB) | 90kW | FE-T230-(x) | 230A | 380VAC | 1.3mA 150mA | 580x250x205 | 560x170 | 22.6Kg. | --- | B | FS-4 |
| SV1100iV5-4 (DB) | 110kW | FE-T400-(x) | 400A | 380VAC | 1.3mA 150mA | 392x260x116 | 240x235 | 10.3Kg. | --- | C | FS-4 |
| SV1320iV5-4 (DB) | 132kW | | | | | | | | | | |
| SV1600iV5-4 (DB) | 160kW | FE-T600-(x) | 600A | 380VAC | 1.3mA 150mA | 392x260x116 | 240x235 | 10.3Kg. | --- | C | FS-4 |
| SV2200iV5-4 (DB) | 220kW | | | | | | | | | | |
| SV2800iV5-4 (DB) | 280kW | FE-T1000-(x) | 1000A | 380VAC | 1.3mA 150mA | 480x280x166 | 280x255 | 18Kg. | --- | C | FS-4 |
| SV3150iV5-4 (DB) | 315kW | | | | | | | | | | |
| SV3750iV5-4 (DB) | 375kW | | | | | | | | | | |
| SV055iV5-2DB (MD) | 5.5kW | FE-T030-(x) | 30A | 250VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.4Kg. | --- | B | FS-2 |
| SV075iV5-2DB (MD) | 7.5kW | FE-T050-(x) | 50A | 250VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.2Kg. | --- | B | FS-2 |
| SV110iV5-2DB (MD) | 11kW | FE-T100-(x) | 100A | 250VAC | 0.5mA 27mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV150iV5-2DB (MD) | 15kW | | | | | | | | | | |
| SV185iV5-2DB (MD) | 18kW | FE-T120-(x) | 120A | 250VAC | 0.5mA 27mA | 425x200x130 | 408x166 | 13.8Kg. | --- | B | FS-3 |
| SV220iV5-2DB (MD) | 22kW | | | | | | | | | | |
| SV055iV5-4DB (MD) | 5.5kW | FE-T030-(x) | 30A | 380VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.4Kg. | --- | B | FS-2 |
| SV075iV5-4DB (MD) | 7.5kW | | | | | | | | | | |
| SV110iV5-4DB (MD) | 11kW | FE-T050-(x) | 50A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.2Kg. | --- | B | FS-2 |
| SV150iV5-4DB (MD) | 15kW | | | | | | | | | | |
| SV185iV5-4DB (MD) | 18kW | FE-T060-(x) | 60A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.5Kg. | --- | B | FS-2 |
| SV220iV5-4DB (MD) | 22kW | FE-T070-(x) | 70A | 380VAC | 0.5mA 27mA | 350x180x90 | 338x146 | 7.5Kg. | --- | B | FS-3 |

X (1) Industrial environment EN 50081-2 (A class) → EN61000-6-4:02
(2) Domestic and industrial environment EN50081-1 (B class) -> EN61000-6-3:02



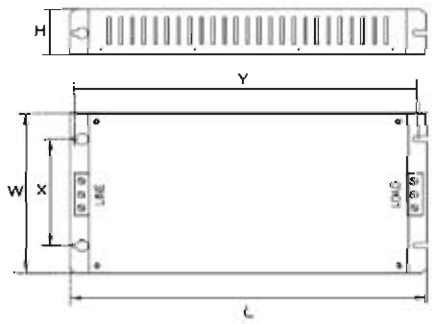

**FS SERIES ( output chokes )**

| CODE | D | W | H | X | Ø |
|---|---|---|---|---|---|
| FS-2 | 28.5 | 105 | 62 | 90 | 5 |
| FS-3 | 48 | 150 | 110 | 125 x 30 | 5 |
| FS-4 | 58 | 200 | 170 | 180 x 45 | 5 |

## DIMENSIONS

### FF SERIES ( Footprint )

FIG. A




### FE SERIES ( Standard )

FIG. B

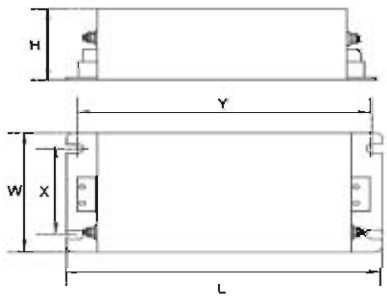
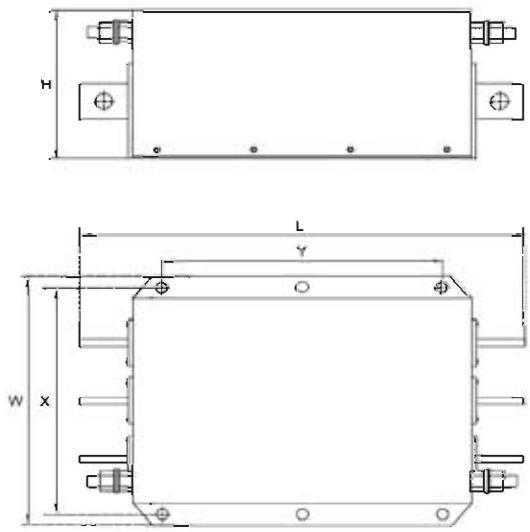



FIG.C




VECTOR MOTOR CONTROL IBÉRICA S.L.
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Tel. (+34) 935 748 206 - Fax (+34) 935 748 248 - info@vmc.es
www.vmc.es

# WARRANTY

| | | | | |
|---|---|---|---|---|
| **Maker** | LS Industrial Systems Co., Ltd. | | **Installation (Start-up) Date** | |
| **Model No.** | **SV-iV5** | | **Warranty Period** | |
| **Customer Information** | Name | | | |
| | Address | | | |
| | Tel. | | | |
| **Sales Office (Distributor)** | Name | | | |
| | Address | | | |
| | Tel. | | | |

Warranty period is 12 months after installation or 18 months after manufactured when the installation date is unidentified. However, the guarantee term may vary on the sales term.

■ **IN-WARRANTY service information**

If the defective part has been identified under normal and proper use within the guarantee term, contact your local authorized LS distributor or LS Service center.

■ **OUT-OF WARRANTY service information**

The guarantee will not apply in the following cases, even if the guarantee term has not expired.

- Damage was caused by misuse, negligence or accident.
- Damage was caused by abnormal voltage and peripheral devices' malfunction (failure).
- Damage was caused by improper repair or altering by other than LS authorized distributor or service center.
- Damage was caused by an earthquake, fire, flooding, lightning, or other natural calamities.
- When LS nameplate is not attached.
- When the warranty period has expired.

You can get various useful informations or services visiting our web site http://www.lsis.biz

## Revision History

| No. | Date | Edition | Changes |
|---|---|---|---|
| 1 | May, 2001 | First Release | Ver. 1.00 |
| 2 | March, 2002 | 2nd Edition | Ver. 1.20 / Added codes |
| 3 | April, 2002 | 3rd Edition | Ver. 1.30 / Changed functions |
| 4 | October, 2002 | 4th Edition | Ver. 1.40 / Added and changed functions |
| 5 | June, 2003 | 5th Edition | Ver. 1.50 / Added and changed functions |
| 6 | December, 2004 | 6th Edition | Ver. 1.70 / Added information on MD type |
| 7 | November, 2005 | 7th Edition | Ver. 1.91 / Changed CI and added capacity |
| 8 | May, 2006 | 8th Edition | Ver. 2.10 / Added funetions |
| 9 | June, 2008 | 9th Edition | Ver.2.40 / Synchronization operation, WEB controlling, 280~375kW Capacity extension |
| 10 | April, 2009 | 10th Edition | Ver2.41 / Battery-operated mode function added |

**Environment management**

LSIS regards the environmental preservation as a high priority, and all our employees do our best for the environmental preservation fresh earth

**Disposable product**

LS inverter is designed for preserving environment.

When you disuse the products, you can recycle by separating them to iron, aluminum, bronze, and synthetic plastic (cover).